## CENSUS

OF THE

## COMMONWEALTH OF AUSTRALIA

TAKEN FOR THE NIGHT BETWEEN THE 2nd and 3rd APRIL, 1911.

# VOLUME I. STATISTICIAN'S REPORT INCLUDING APPENDICES.

OF THE

MINISTER OF STATE FOR HOME AND TERRITORIES.

BY

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### PREFACE.

In issuing Volume I. of the Census of the Commonwealth of Australia, 3rd April, 1911, it may be pointed out that Volumes II. and III. were published on 30th September, 1914. At that time it was intended to issue shortly thereafter Volume I. containing the Report of the Statistician and other matter. The disorganisation of duties which resulted from the war and the work involved in the taking of the War Census of 1915 were, however, so great that it has been found impracticable to complete the Volume until now.

The Report, which occupies 438 pages of the present Volume, furnishes in some detail an historical review of Census-taking—ancient, mediæval, and modern—and provides an analysis of the data collected and tabulated at the Australian Census of 1911. In the presentation of the data in this Volume, graphical representation has been freely used, and a series of maps has been provided for the purpose of illustrating the geographical distribution and density of the population. A series of Appendices is attached to the Report: these contain copies of the principal instructions issued to Supervisors, Enumerators, and Collectors, and the Reports on the collection in the several States furnished by their respective Supervisors. A special feature of the Volume is Appendix A, which, with its index, etc., covers 466 pages, and which, for convenience in issue as a separate publication, has been paginated separately from the earlier portion of the Volume.

This Appendix contains the results of a number of extended investigations made with the object of formulating at least some of the elements of a mathematical theory of population, and of resolving and interpreting the large body of crude demographic data, which has been accumulated in the statistical records of Australia.

In conclusion, I desire to place on record my appreciation of the services rendered, directly or indirectly, by the senior officers of the Bureau in connection with the work of the Census. Mr. H. Spondly, who was placed in charge of the organisation for the collection of the Census material; Mr. C. H. Wickens, A.I.A. (now Supervisor of Census), who directed the tabulation and analysis of the data; Mr. Gerald Lightfoot, M.A., F.S.S., Barrister-at-Law, to whom were allotted all matters relating to the history of Census-taking, and the preparation of an account of the preliminary arrangements for the Census of 1911; and Mr. F. W. Barford, M.A., A.I.A., who helped in the compilation of the Life Tables; all rendered valuable assistance; while Messrs. J. Stonham, M.A., E. T. McPhee, and F. D. Rossiter, M.A., rendered material aid by assuming increased responsibilities, involved through other officers being directly engaged on Census duties.

G. H. KNIBBS, Commonwealth Statistician.

Census Bureau,
Melbourne,
21st May, 1917.



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## CORRIGENDA.

Page 159. For "Section 4" read "4(a)."

Page 290. Section 15. Table. The word "Years" should be omitted from the columns headed "Average Issue."

Page 334. Graphs Nos. 128 and 129. Heading. For "  $(l_x$  )" read "  $\stackrel{\diamond}{(e_x)}$ ."

#### CENSUS OF THE COMMONWEALTH OF AUSTRALIA

3rd APRIL, 1911.

#### CHAPTER I.

#### HISTORICAL REVIEW OF CENSUS DEVELOPMENT.

#### SECTION I.—INTRODUCTION.

1. **General.**—Under the Commonwealth of Australia Constitution Act 1900, the Commonwealth Government is empowered "to make laws for the peace, order, and good government of the Commonwealth, with respect to," *inter alia*, "Census and Statistics." In exercising the power so conferred, a "Census and Statistics Act" was passed in 1905, and in the following year the "Commonwealth Bureau of Census and Statistics" was created. Part III. of the Act of 1905¹ provides for the taking of a census decennially, and in accordance with this provision a census of the Commonwealth was taken for the night between the 2nd and 3rd April, 1911

As the publication here presented forms the Report of the first census taken for the whole of the Commonwealth under the Federal Constitution, it has been thought desirable to furnish a fairly complete, though necessarily a condensed, account of the historical development of census-taking from the earliest times. The history of census-taking in Australia is referred to briefly in the part of Chapter III. dealing with "British Dominions," but a separate and more complete account will be found in Chapter IV. hereinafter.

- 2. The Census at Various Periods.—The word "Census," without other qualification, is now almost solely used to denote the enumeration of the people, periodically undertaken in most European countries, in the United Kingdom, in the British Colonies, in the United States of America, and in certain other countries. It may, of course, include other elements, as wealth, production, etc.
- (i.) Origin of the term Census. The Latin term, "Census," originally implied an enumeration of the people by the Roman Censors, who were charged with (a) the official registration of citizens (census), (b) the superintendence of public morals (regimen morum), (c) arrangements for the valuation of property, (d) the collection of the public revenue, and (e) the execution of public works. The Roman Census had special regard to fiscal matters and to the adjustment of civic rights and obligations on a numerical and property basis, and it appears that the statistic or economic aspect of the process of enumeration, viz., as a valuable source of knowledge for the purposes of morals or legislation, occupied a less prominent place than in the earlier censuses of Babylon, and the later ones of mediæval times.
- (ii.) Earliest Known Enumerations. It would appear that in Babylonia, enumerations of the people were carried out at a very early date (prior to B.C. 3800).<sup>2</sup> In Egypt also "numberings" of the people took place certainly as early as about B.C. 2500.<sup>3</sup> In China, statistical results date as far back as about 3000 B.C., while in ancient Greece systematic statistical inquiries, both as to population and other matters, were frequently undertaken. In Rome fairly elaborate statistics commenced from the time of Servius Tullius, while the first census in the presence of the Censors was in 435 B.C.
- (iii.) The Roman Census. The scope of inquiry of the Roman Census was in some respects elaborate, embracing not only the number and classes of all free persons, but also their domestic positions as fathers or mothers, husbands or wives, and sons or daughters. Slaves and freedmen were included with the personal possessions of the head of the house, and real property was classified according to its character.

<sup>&</sup>lt;sup>1</sup> The provisions of the Census and Statistics Act 1905, in regard to the census, are dealt with in detail in Chapter V. hereof. <sup>2</sup> "The First of Empires," by W. St. Chad. Boscawen. Harper Bros., London, 1903, p. 147, <sup>3</sup> Ibid, and also "A History of Egypt," by J. H. Breasted. Hodder & Stoughton, London, 1906, p. 44.

- (iv.) The Hebrew Census. Several enumerations of the Hebrew race are referred to in biblical history. Unlike both the Roman and the modern census, the Hebrew Census was ordinarily undertaken with the object, mainly, of ascertaining their available military strength, but would appear to have sometimes included matters of fiscal import. Probably the technique of the Hebrew Census was derived from the Egyptians, and both from the Babylonians.
- (v.) Mediæval Census. Though special branches of general statistic were often very fully developed in the Middle Ages there are practically no recorded instances of general censuses of population being carried out, and it was not until the 17th century that census-taking was revived. Since that time censuses have been instituted or reinstituted in all the more important countries of the world.
- (vi.) The Modern Census. At the present time the primary object of a census is the demographic one, viz., to supply information as to the numbers and local distribution of the population, the numbers of each sex and age, their so-called conjugal condition (i.e., whether single, married, widowed, or divorced), and their birthplace. This is the minimum Many other facts concerning the amount of information necessary for administrative purposes. population, however, are of importance to the economist and publicist, and ordinarily the census is the only means by which the requisite data can be collected. Of these desiderata the following may be mentioned:—The size and structure of the family, its position in the social scale, the economic position of its head; the nature of employment of its members, the wage or income of each member and of the family as a whole; the rent and size of their house; their educational condition; their religions; and their infirmities. These are the raw materials from which are deduced, in conjunction with statistics of mortality, valuable secondary results, such, for example, as tables representing the probable duration of life, the relative mortality at various ages, in various occupations, and according to conjugal condition, to birthplace, etc. desirable to collect many other things in a census: for example, the relative extent to which the population is employed, the value of possessions, the quantity of currency in use, etc. The question as to which of the matters referred to shall be investigated and which neglected is now ordinarily decided by expediency rather than on principle, and is influenced mainly by two factors, viz., the intelligence of the community in responding to inquiries, and the cost of making the inquiries and analysing the results. The considerations affecting the development and structure of the schedules, by means of which the information to be tabulated is collected, are further discussed in a later part of this Report. (See Chapter II.).

#### SECTION 2.—CENSUSES IN ANCIENT TIMES.

1. Babylonian Census.—In Babylonia the census dates back to a very early period—certainly prior to B.C. 3800—in connection with what appears to have been a perfect fiscal or revenue control, by which the wealth of the country could be estimated minutely. No such system is known to have existed in any other ancient country: perhaps it was most nearly approached by the administration of Egypt in the time of the 18th dynasty, under the priests of Amen. Prior to the consolidation of the Empire, and the centralisation of the administration in Babylon, about B.C. 2300, each district had its own returns. For the purpose of ascertaining the country's wealth, an accurate survey and census was made, and was perfected about B.C. 2500.

Our knowledge of this, and of the ancient Revenue Board by which it was carried out, is derived from a series of some 30,000 tablets found at Tello or Sirpurra, dated in the reigns of the Kings of the 2nd dynasty of Ur. These reigned from about B.C. 2500 to 2300. The major portion of these tablets is now preserved in the British Museum. They refer to the administration of the temple property, to agriculture, stock-raising, the produce of farms and gardens in the district, and are the returns of cadastral surveys of the districts. The surveys appear to have been made at intervals of about 6 or 7 years.

Careful inventories of live-stock, asses and oxen were drawn up, and butter, honey, milk, wool, and even vegetables were inventoried.

2. Egyptian Census.—In Egypt, as far back as 3050 B.C., the systematising of the arrangements for the construction of the pyramids demanded a considerable body of statistics; about 2200 B.C., maps of the whole country and statistical data relating thereto were compiled; and about 1400 B.C., a complete cadastre appears to have been made by Ramses II. For the purpose of carrying on public works as well as for taxation and census records the country was divided into administrative districts. An elaborate registration system was in force; every head of a family was enrolled, with all members belonging to his household.<sup>2</sup>

In the organisation of Egypt under the Romans, a census was provided for and "lao-graphoi" were appointed in each village for the sole purpose of collecting census returns.

¹ See "The First of Empires," pp. 147-8. W. St. Chad. Boscawen. Harper Bros., London, 1903. ² See "A History of Egypt," p. 165. J. H. Breasted, Ph.D. Hodder & Stoughton, 1906. ³ The census or enrolment was called a  $\lambda ao\gamma\rho a\phi ta$ . ⁴ See "The History of Egypt"—Under Roman Rule—by J. G. Milne, M.A., pp. 6-8. Methuen & Co., 1898.

- 3. Early Chinese Census.—The historical development of general statistics has been traced by various writers as far back as the earliest of the civilised nations, viz., the Chinese. In the year 550 B.C., the book known as the Shu-king, was compiled by Kong Fu-tze (Confucius). This book was translated into French in the year 1770, under the title "Le Chouking, ouvrage recueilli par Confucius." It dealt not only with the enumeration of the people and the survey of the country, but also furnished, among other things, agricultural, industrial, and commercial statistics from the time of the Emperor Yu, about 3000 years before the Christian era.
- 4. **Hebrew Census.**—The Hebrew Census was ordinarily undertaken with the object of ascertaining the number of adult males available for military purposes, and, unlike the Roman Census, was not, as a rule, employed for the assessment of taxes. The first biblical record of an enumeration of the people is in the book of Exodus (xxx., 11-16), where it is stated that Moses was directed to number the children of Israel, and to levy a poll-tax of half a shekel of silver per head. The assigned date of this was B.C. 1491 (Usher's Chronology).
- B.C. 1490—The first systematic census biblically recorded was, however, that undertaken by Moses and Aaron about B.C. 1490, during the wandering of the Israelites in the wilderness of Sinai.<sup>2</sup> The number of adult males was found to total 603,550, exclusive of the Levites, whose duties as ministers of the Tabernacle rendered them exempt on this occasion, but of whom separate censuses were subsequently made.<sup>3</sup>
- B.C. 1017.—Four hundred and seventy-three years appear to have passed before any further numbering occurred, when, in B.C. 1017, a notable census was carried out by the Hebrew King David, through the unwilling agency of Joab, who was directed to go through all the tribes of Israel, from Dan to Beersheba, and to number the people. There are two accounts of this census, which appears to have been undertaken primarily for military purposes. (a) According to the book of Samuel<sup>4</sup> "the valiant men who drew the sword" of Judah and Israel numbered 1,300,000. It would appear, however, that this number was incomplete, for after numbering for 9 months and 20 days, it is subsequently stated<sup>5</sup> that Joab "finished not, because there fell wrath for it against Israel." (b) According to the first book of Chronicles<sup>6</sup> the number of men of Israel and Judah "that drew sword" was set down as 1,570,000. It is interesting to note that although, according to the usually accepted chronology, nearly 500 years had elapsed since the enumeration by Moses, the number of fighting men in Israel and Judah had but little more than doubled; a smaller rate of increase than any of which there is recent experience. The many points of uncertainty in the record makes it, however, impracticable to draw any definite inferences. It has been stated that the biblical account of the Divine wrath, which resulted from the action of David in carrying out this enumeration of the Israelites, had the effect of delaying the adoption of the census by Christian Europe for many years.
- B.C. 1017 and 1015.—Two censuses of the number of strangers in Israel were taken, in connection with the building of the Temple, by the commands of David<sup>7</sup> and Solomon<sup>8</sup> respectively. The number enumerated at the latter of these was 153,600, and their object was, apparently, to ascertain the amount of available labour which could be impressed for the construction of the Temple.
- B.C. 536.—In this year a census was taken of the number of Children of the Captivity, with a record of their servants, their horses, mules, camels and asses. They numbered 42,360, besides 7337 servants and 245 singing men and women. Other occasions are also mentioned in the Bible, viz., when from time to time the Hebrew people or single tribes appear to have been enumerated, either for purposes of taxation or war.
- 5. Greek Census.—In ancient Greece the various classes of citizenship, their privileges, obligations, property, and taxes, demanded the institution of many statistical inquiries of a systematic character. In Solon's tax-census, in 594 B.C., the people were divided into four classes, according to the returns of their property estimated in wheat, and a poll-tax was imposed on alien residents; this system seems to have remained in force until the time of Herodotus, about B.C. 450. A census taken in Athens in 309 B.C., distinguished the different classes in the population, there being 21,000 citizens, half that number of aliens, and nineteen or twenty times that number of slaves.
- 6. Roman Census.—The object and nature of the Roman Census has already been referred to (see Sec. 1., § 2. hereinbefore). With the exception of the employment of the information collected for the apportionment of rights and duties, little, if any, use appears to have been made of it. Its utility for any of those sociological and other purposes, for which statistical knowledge is now deemed so valuable, was not appreciated. The Roman Census was, however, found to be of such benefit for the purposes for which it was designed, that it came to be a regular and recognised Roman institution, conducted at frequent intervals, generally, it would appear every fifth year.

Bibliogr. hist. de la Stat. en Allemagne, Heuschling (Bruxelles, 1854). Preuss. Stat. Zeitschrift, Engel, (Berlin, 1862); Handbuch der Statistik, v. Scheel, 1880.
 Numbers, i., 1-46.
 Numbers iii., 14-22, and iv., 34-49; and I. Chronicles, xxiii., 3.
 II. Samuel, xxiv., 1-17.
 I. Chronicles, xxvii., 24.
 I. Chronicles, ii., 17.
 Ezra, ii., 1-61, and Nehemiah, vii., 6-69.
 See Herodotus, Bk. II., c. 177.

- (i.) Censuses Recorded by Livy. Livy, the Roman historian (born B.C. 59, the year of Cæsar's first consulship), refers on several occasions to the taking of census, viz.:—
- B.C.  $457.^1$  "The census commenced in the preceding year is completed, the number of citizens rated being 117,319."
- B.C.  $193.^2$  "Cornelius now closed the lustrum, the number of citizens rated being 143.704."
- B.C. 188.<sup>4</sup> "The Campanians were directed by the Censors, in accordance with a decree of the Senate issued during the previous year, to be included in the general Census of Rome." . . . . "Marcus Claudius Marcellus, the Censor, closed the lustrum, 258,308 citizens being rated."
- B.C.  $173.^5$  "This year the lustrum was closed. . . . . At this census 269,015 Roman citizens were rated."
- (ii.) Roman Censuses Recorded in the Bible. There are two Roman Censuses referred to in the New Testament.
- B.C. 5. Mention is made by St. Luke<sup>6</sup> of a notable census, taken about B.C. 5 (according to the usually accepted chronology) by the command of Cæsar Augustus, who issued a decree "that all the world" (*i.e.*, the Roman Empire) "should be taxed" or enrolled. This was the first census undertaken whilst Cyrenius was Governor of Syria.
- A.D. 3 (circa). A few years later it appears that another census was carried out by Cyrenius, during which occurred the revolt of Judas of Galilee and his followers.
- (iii.) Censuses Recorded by Tacitus. Several censuses are mentioned by the Roman historian Tacitus, who lived in the latter half of the first and in the early part of the second century of our era.
- A.D. 14. Tacitus<sup>8</sup> states that, in this year, during the reign of Tiberius Cæsar, the German Legions mutinied against Germanicus, their General, whilst he was carrying out the assessments (census) of Gaul, and that, during the collection of the taxes, Germanicus received news of the death of Augustus.
- A.D. 16. In this year Publius Vitellius and Caius Antius were appointed to continue the collection of the taxes (census) of Gaul.
- A.D. 48. The Emperor Claudius closed the lustrum in A.D. 48, the number of citizens enumerated amounting to 5,984,072. This number, however, apparently included only the males between the ages of 17 and 60.9

#### SECTION 3.—MEDLÆVAL CENSUSES.

- 1. Adoption of Census by Christian Europe.—After the sacking of Rome (A.D. 410), the practice of census-taking appears to have fallen into disuse, and a period of at least twelve hundred years elapsed before the census was adopted by Christian Europe. In the opinion of some authorities the biblical account of the Divine wrath against David's enumeration of his fighting men effectually discouraged any census undertaking. It may be observed, however, that in mediæval times the real nature and value of the census was hardly recognised, since neither taxation nor the adjustment of social rank required an enumeration of the people, while its economic or statistic utility was even less appreciated than by the Romans.
- 2. Mediæval Censuses.—During the Middle Ages, taxes, military service, tithes, and customs duties gave rise to inquiries and records to some degree of a statistical character, and various compilations were published in Europe dealing in a descriptive manner with different states or countries. Though these publications can hardly be said to have a close degree of similarity with the census, either ancient or modern, they served to some extent the same purpose, and one of the latest directions in the evolution of the modern census is, after all, somewhat in the same direction, viz., to enumerate not only individuals, but also their belongings; we need not only a census of population, but also a census of industry, of production, and of wealth.

<sup>&</sup>lt;sup>1</sup> Livy, III., 24. <sup>2</sup> Livy, XXXV., 9. <sup>3</sup> The census was followed by a sacrifice of purification or lustration, whence the term of five years came to be designated a lustrum. <sup>4</sup> Livy, XXXVIII., 36. <sup>5</sup> Livy, XLII., 10. <sup>6</sup> St. Luke, ii., 1. <sup>7</sup> Acts, v., 37. <sup>8</sup> Tacitus, I., 31. <sup>9</sup> Tacitus, XI., 25.

The publications referred to were ordinarily of the nature of cosmographies, and consisted generally of a description of the country, its soil and production, national character-religion, customs, internal and external relations of the people, their military strength, and economic position. Among notable examples of such compilations may be mentioned the following:—

- (a) A.D. 807. Caroli Magni Memoratorium.
- (b) A.D. 808. Brevis Capitulorum. (The Breviary of Charlemagne).
- (c) A.D. 830. Al-Mamun's Description of the Khalifate.
- (d) A.D. 1086. The Domesday Book of William the Conqueror.
- (e) A.D. 1231. The Land Register of the Danish King, Waldemar II.
- (f) A.D. 1515. Macchiavelli's "Ritratti della Francia e della Allemagna."

It is stated (on the authority of Mr. H. H. Risley, of H.M. Bengal Civil Service) that during the 13th century, at about the time when the Venetian traveller Marco Polo visited China, a census of Tibet was taken by Kubla Khan.

#### SECTION 4.—REVIVAL OF CENSUS-TAKING IN MODERN TIMES.

1. Revival of Census-taking.—During the 16th century various statistical compilations, answering to the same ideal as that of the medieval cosmographies, were made. It would appear, however, that there is no record of any regular and systematic census being taken during the Middle Ages, nor indeed until the 17th century, when the credit of first attempting the compilation of population statistics in more modern times belongs to the Canadian Province of Quebec, or La Nouvelle France, as it was then called, where between the years 1665 and 1754, no fewer than fifteen regular censuses were taken, most of them nominal—that is, recording by name every individual enumerated. During the latter portion of the same period seven censuses of Nova Scotia (then Acadia) and six of Newfoundland were also taken. In Europe, registration of local citizenship was commenced in Württemburg in 1622, but systematic records of population do not appear to have commenced until the 18th century. In 1719, Frederick William I. of Prussia began his half-yearly accounts of population, their occupations of houses and real estate generally, and of finances, taxes, etc. Enumerations of the people took place—in Hesse-Darmstadt, 1742; Hesse-Cassel, 1747; Sweden, 1748; Gotha, 1754; Saxony and Hanover, 1755; Brunswick, 1756; Denmark, 1769; Bavaria, 1777; Mecklenburg-Strelitz, 1784; German Austria, 1785; Spain, 1787; the two Sicilies, 1788; and in Savoy and Nice in 1789.

In the United States the first census was taken in 1790. In England and in France the first regular censuses were taken in 1801, in Norway in 1815; in New South Wales in 1828; in Belgium in 1831; while in later years, during the 19th century, censuses were instituted in nearly all the remaining important countries of the world.

2. Later Developments of the Modern Census.—Before proceeding to discuss further the development of the modern census, it will be convenient in the next Chapter to give some idea of the chief objects of the census, the various methods of enumeration, the forms of schedules used, the scope of the census, methods of tabulation, and the periodicity of the census in the more important countries of the world. The development of the census in each of these countries will then be briefly dealt with in Chapter III, and in Chapter IV. a more complete account of census matters in the Commonwealth will be given.

<sup>&</sup>lt;sup>1</sup> See Geschichte, Theorie, und Technik der Statistik, von Professor Aug. Meitzen, Berlin, 1886

#### CHAPTER 11.

#### MODERN METHODS OF CENSUS-TAKING.

#### SECTION 1.—OBJECTS AND USES OF THE CENSUS.

1. General.—Though it would appear, as has already been stated, that the principal objects of the census in early times were merely either to ascertain the military strength of the nation, or to assess taxes and adjust the rights and duties of the citizens, the results obtained from the census at the present time are of the utmost importance, and of a very varied character. They form the necessary basis for many administrative, sociological, and other inquiries. Further, the elucidation of many questions affecting the political, economical, and social welfare of the community is possible only through their existence. The more prominent objects of the modern census may be conveniently dealt with under the following heads:—

#### Demographic.

- (i.) Population and its distribution.
- (ii.) Sex, age, and conjugal condition.
- (iii.) Birth rates.
- (iv.) Marriage rates.
- (v.) Death rates and Life Tables.

#### Social and Economic.

- (i.) Families, dwellings, education, religion, and occupation.
- (ii.) The infirm and dependent.
- (iii.) Scale of emolument, scope, and continuity of employment.
- (iv.) Currency.

#### Ethnographic.

- (i.) Race and nationality.
- (ii.) Immigration.
- (iii.) Environment.

#### Statistical and Administrative.

- (i.) The Standardisation of statistical data.
- (ii.) Financial.
- (iii.) Administration.
- (iv.) General.
- 2. Demographic.—(i.) Population and its Distribution. The principal object of censustaking, and the one probably which is best understood and arouses the greatest measure of public interest, is the determination of the aggregate number of persons in the community and their local distribution, as well as the progress or decline of the community in all its varied aspects since the date of the preceding census. The changes which have occurred during the intercensal period expressed either absolutely, or relatively to similar changes during previous intercensal periods or among other communities, are disclosed.

Whether the population is rapidly or slowly increasing, whether it is aggregating itself at centres or is distributing itself over the country, whether the production of wealth or other benefits in any locality relate to few or many, whether political representation will be affected; these and similar questions are answered only by means of a census.

(ii.) Sex, Age, and Conjugal Condition. Population falls into natural groups according to two characteristics present everywhere, viz., sex and age, and although the distribution according to conjugal condition (single, married, widowed, or divorced) does not depend upon natural causes, but upon the social institution of marriage, this institution is so well established in civilised communities, that the classification of the population according to conjugal condition is comparable in importance to classification according to sex and age.

Serious differences between the number of males and females affect marriage, the increase of population, and the economic condition of the community, and the characteristics of sex distribution react on various social phenomena, such as morality, disposition to disease, manifestation of vice and crime, etc., thus exemplifying the fundamental importance of a classification, according to sex. It is equally obvious that the classification of occupations according to sex is of a social and economic significance, which would be difficult to exaggerate.

As regards age, it is important to know whether a community is normally or abnormally constituted; for example, whether it has an excessive number of children and old people, thus increasing the burden on the productive class; or has a deficiency of children, pointing to depopulation and race-suicide. Incidentally it may be noted that emigration and immigration are reflected in the numbers of persons at each age, thus disclosing whether the economic power of a nation is losing by drafts on the full-grown and able-bodied, or whether its power is increasing by additions to its adult and vigorous life. Again, the numbers between certain ages furnish evidence of military and voting power. In many instances particular sections of the community, differentiated according to age, afford the only appropriate standards for the observation of social phenomena. For example, a full analysis of the phenomena of changing birth rates presupposes that the number of women of marriageable age and their reproductive efficiency at each age can be taken into account, since the potential element in the growth of population is the number of women of child-bearing age, and to a less extent the suitable ages of their consorts. Thus, to obtain a measure of other considerations operating to facilitate or retard the exercise of the maternity function, the measure of the potential element is essential, and without a census these considerations could not be satisfactorily studied. The incidence of disease, mortality, criminality, and similar phenomena vary in intensity with variation in the distribution of sex and of age-classes. Hence, classification by sex and age permits of the elimination of causes of variation, dependent merely upon the accident of particular numbers, and enables search for causes arising from human tendencies, motives, or economic conditions, etc., to be made. short, it gives precision to any possible deductions.

Conjugal condition reflects the changes taking place in the social organisation. Hence economic independence of women reacts on the relative numbers of single and married, and the latter must be studied in relation to growth of population, to the number of births, to the constitution of the family, as well as in relation to social morality. Both widowhood and divorce have important economic and social effects, and the influence of both the married and widowed states are marked in the phenomena of death, disease, insanity, suicide, vice, and crime. Thus the combination of conjugal condition and age reveals many important relations.

(iii.) Birth Rates. The immediate cause of an increase or decrease of population is ordinarily due to the relation of the number of births to the number of deaths. The facts for a particular country may be distorted by emigration or immigration; when it is remembered, however, that with a population of any size it is far more easy to recruit its losses and to develop it by natural increase than by immigration, it is easy to see that statistics of births and birth rates are of primary importance. The crude birth rate (usually expressed as the number of births per 1000 of the population) can be ascertained accurately only by the help of the census, since during intercensal periods all estimates of rate have to be based on more or less imperfect estimates of population. The number in the community given by any one census and the enumeration result of the following census, constitute the initial and closing values for all intercensal estimates of population, by means of which all intercensal adjustments are made possible. Estimates of the death rate and of the relationship between the birth rate and death rate are obviously limited in a similar way.

The birth rates occurring among different classes in the community, as, for example, urban and rural, rich and poor, agricultural and industrial, have obviously a far-reaching significance in regard to national evolution, and behind these are many questions of deeper significance, viz., the characteristics of fecundity, the factors conducing to a large or small birthrate or producing variations therein, the age of life at which these operate, the light they throw on the growth of national tradition, etc. By means of the census, in conjunction with statistics of birth, investigations can be carried out with a view to ascertaining climatic, topographical, and seasonal influences on the birthrate, the influence of similarity or disparity in the ages of parents, etc. The influences of race, density of population, residence in town or country, occupation, economic prosperity, and social position on birthrate, are each important as regards national welfare, and it is the census alone which provides sufficiently accurate data for elucidating these problems, which, notwithstanding their immense importance, have so far been inadequately attacked.

(iv.) Marriage Rates. The most significant sociological event in the life of man is marriage. For the community it has significance, not only because the number of marriages profoundly affects the maintenance of the population strength, but also because marriage establishes the family and through its influence on the life of the individual permeates all the phenomena of social life. As with birth-rates, so with marriage-rates, only by means of periodic censuses can they be ascertained. A sudden decline in marriage-rate is usually referable to some economic calamity or to the shock of war; a gradual decline may be due to diminishing economic prosperity or to some change in social condition, habits, or public opinion. A gradual rise is ordinarily an index of economic prosperity, of hopefulness in regard to the future, and for national destiny probably always a hopeful sign.

Just as in the case of birth rate, so with marriage-rate, there are many causes, both physical and psychical, affecting its frequency, such, for example, as climate, season, race, prosperity or adversity, laws, public opinion, social ambition, etc. The attempt to measure the effect of these on national destiny demands precision in data, because here it is the *change* of rate which is to be ascertained, and the labyrinth of sociological laws can be traced out only when the movement of this change is exactly ascertained.

(v.) Death Rates. Since, disregarding the effects of immigration and emigration, increase in population depends upon the difference of birth rate and death rate, any peculiarity in the latter must necessarily be reflected in the features of the population increase. This rate, which is similarly dependent upon the census for its determination, is an index of the fluctuating condition of the community, of the salubrity of localities, or of the conditions of its life. Wars, epidemics and adversity on the one hand, or prosperity, peace, and social morality on the other, reflect themselves in the fluctuations. Its variations are the pulsations of the social life, and by its means many useful investigations may be carried out. For example, excessive mortality or morbidity rates furnish evidence of the need and necessary directions for prophylaxis. And it may be here remarked that statistical results of such a nature have disclosed the fact that popular impressions are often wholly erroneous. The variation of death rate with sex, age, and conjugal condition; in different localities and climates; according to seasons; among different races; in town and country; and in different occupations; is of importance to the student of social science, and to those charged with public administration.

It is worthy of note that it is only through the statistical precision attained by means of the census that the requisite data for the construction of general life tables can be obtained. Such tables are of practical and scientific value, and shew with what degree of success a community is guarding its vital forces. In its simple form a national life table shews the number of persons who, out of a given number born in any community, will attain each successive year of age, and therefore shews also the number who will die each year until all are extinct. It may here be added that such tables as are referred to are desirable for each community, and are essential in all cases where conditions of life diverge materially from those of communities for which such tables are already in existence.

3. Social.—(i.) Families, Dwellings, Education, Religion, and Occupation. Social condition is intimately related to the family and family life. Hence an enumeration of families and a description of their composition as to number form the data for a study of sociological development. For example, the number living alone and living in families of specified sizes indicates the social tendencies of the people, and their inclination for the married state, while the varying size of families affords evidence of the fertility of the population. The social significance of particulars as to families requires to be interpreted in connection with other facts, as, for example, relatively small families may, on the one hand, indicate prudence and foresight, and result in comfort, well-being, and low death rates, or may, on the other hand, express a state of things by no means consistent with national well-being. As indicative of the influence of other phenomena, such as the effects of urban life, national competition, increase of luxury, change in domestic or religious ideals, statistics of families are of interest and value.

The number and kind of houses occupied by the community, the number of persons and families aggregated in a single house, are important indications of the social condition of the people, and the value of the information is increased when the constitution of the dwellings, *i.e.*, the material of which they are constructed and the number of rooms therein, is known; classification of houses and their actual value as dwellings becomes increasingly important, for with the crowding of population into large cities the social problem of house accommodation has of recent years become more complex.

The condition of a people may be gauged by its intelligence or by the prevalence of education. Ignorance often reinforces poverty, vice, and crime, and though men are not made moral by a knowledge of "the three R's," yet an intelligent community lives on a higher plane of moral life. The present means of obtaining information by the census as to the intelligence of the community by the enumeration of illiteracy is unsatisfactory, and must be regarded merely as a makeshift. The single test of absolute illiteracy is very crude, but taken in conjunction with statistics of educational facilities, it serves to give some rough idea of the efficiency of the educational machinery.

Religious belief furnishes a definite classification of population, and, although the political significance of religious differences has, perhaps, less weight to-day than formerly, there is still a public demand for an enumeration of the number of adherents of each sect. In cases where an inquiry as to religious belief is instituted, it is ordinarily left optional to reply. Certain characteristics appear to accompany different religions, so that the statistics thereof are not without value as an index of social condition.

That the classification of the people according to occupation and economic condition is of fundamental importance is obvious. It is the material for an intelligent review of national industry or of what is implied in the terms capital and labour, employers and employees, masters and servants, rich and poor, producers and non-producers, plutocracy and wage-slavery. The correlation of these things with physical conditions and physical environment, the incidence

of natural phenomena as revealed in their fluctuation, demand a close study of those well-enumerated facts that a census alone can supply. These various phenomena are complex and involved; indeed the complexity of social life is like that of a living organism, and the classification and arrangement of its various characteristics, and the analysis of its numerous interrelations are essential to disentangle cause and effect. In most cases all that can at present be done is to carefully review the facts and wait for future knowledge to show the proper correlation and the appropriate scheme for complete analysis.

The sociological inquiries which can be instituted under the above heads are at present limited by the very elementary questions to which trustworthy answers can be obtained.

- (ii.) The Infirm and Dependent. Since in every community there is a certain number of persons who suffer from some form of physical or mental infirmity, their presence indicates some limitation in the social organism, or in the physical or moral life or environment of the people. Thus their enumeration, when accurate, is of value. Since, too, in a well-ordered State, a study of the condition of these persons with a view to its amelioration, is essential both for their own sake and that of the community, a census cannot wholly neglect to take account of infirmities. Unfortunately in many cases, however, satisfactory answers cannot be obtained, as, for example, in respect of mental alienation and imbecility, and in impaired vision or hearing, in nervous instability, etc. In these the degree of the defect is important; yet popular replies would be nearly worthless. For this reason, and with a community at present insufficiently instructed in the matter, the inquiry has, on the present occasion, been restricted to questions as to total blindness and deafmutism.
- (iii.) Scale of Emolument, Scope and Continuity of Employment. The ultimate object of any inquiry as to salary or wages is to determine the amounts of annual earnings of different sections of the community classified according to occupation, to economic condition, or in some similar way. In conjunction with statistics of production and of rates of wages this inquiry furnishes material for the answer to many important questions relating to the economic condition of various classes of the community and to the state of the market for labour. comparision of daily or weekly earnings in different occupations would, however, be insufficient. Most trades vary in activity with the season of the year, the difference being frequently very great; at any particular time therefore it might happen that for one industry the results would be exceptionally favourable, and for another exceptionally unfavourable. To avoid comparisons on different bases therefore, and since the number of full weeks' wages obtained in a year is not known, except in certain non-intermittent trades, it is necessary to supplement any census inquiry as to amounts of wages or salary by another inquiry as to average time worked during a year. The investigation may then resolve itself into subordinate inquiries in regard to the condition of workers in various occupations at different places and at different times. inquiries may be grouped under the following heads:—(a) To determine the ordinary annual incomes in different occupations; (b) To compare the incomes in different occupations in different countries, or in different parts of the same country; (c) To compare incomes at different periods; (e) To correlate money wages with cost of living in all the preceding cases, i.e., to measure the efficiency of wages; and (f) To correlate wages with other economic phenomena. The proposal to include in the Australian Census Schedule of 1911 an inquiry as to scale of emolument, was overruled by a resolution of the Federal Senate.
- (iv.) Currency. Statistics of the production, use, and movements of currency are of value, since the monetary and credit system of every country are influenced by the amount and velocity of movement of its supply of money. The actual quantity of money in existence; the rapidity of its circulation; the extent of the use of paper money, cheques, and other credit instruments by means of which the use of coin is to a large extent obviated; are all elements of importance in the financial system of a nation. These are all influenced by the character of the trade, whether wholesale or retail, whether internal or international, whether for cash or credit, and upon the habits of the people in the use of cheques and bank accounts. A knowledge of the amount of currency in existence is essential in any thorough consideration of the relation of money to prices, and since a change in price-level affects all incomes, an inquiry as to this matter must be of interest to every member of the community. And it may be added that the velocity of circulation of currency, itself a measure of the efficiency of the monetary system of any community, demands for its determination the quantity of currency involved: without this quantity the solution of the problem is not possible. The proposal to include in the Australian Census Schedule of 1911 an inquiry as to amount of currency in actual circulation was also overruled by the Federal Senate.
- 4. Ethnographic.—(i.) Race and Nationality. The ethnological is the most general division of mankind, and though no rigid classification of the distinguishing marks of race or stock has been generally adopted, there are important influences both upon social organisation and the economic life of the community associated with the term "race." Closely connected with the distinction of race, and more or less correlated therewith, is the distinction of nationality, though members of a nationality are not, of course, necessarily members of the same race. Both of these have immense importance for the sociologist, especially in his study of origins, and in his study of national and racial characteristics. Some writers, for example, appear disposed to associate free political institutions with the spread of the Anglo-Saxon race, believing that, wherever he is found, his racial tendency will thus express itself.

The relative strength of different nationalities held together in the same political unity, as in Australia, is often an important economic as well as social question. To follow the intermixture of nationalities, such as is going on in the Commonwealth; to follow the foreign-born in their distribution over the country, in their choice of occupation, possibly in their effect on the moral and social welfare of the community; is of obvious sociological importance.

- (ii.) Migration. A priori, it is evident that migration may have considerable influence upon the population, both of the country losing the migrants, and of the country receiving them. It is the object of the census to describe and analyse the quality of migration, especially immigration, according to the race or birthplace of the individuals, their sex, age, and conjugal condition, and their occupation and economic condition. All these questions are important in considering the effect of immigration; by depicting the ebb and flow of migration it may be possible to indicate the influences which govern its intensity and direction. Migration gives rise to ethnical mixtures, and to complicated questions of the reciprocal influence of men of different races and culture upon each other. Such questions involve not merely the number of the population, but the whole social and economic development of the community. Besides migration from one country to another, an almost equally important phenomenon is the change of residence of people within a country. A typical example of this is the migration from country to city, a tendency strongly expressing itself in the features of modern life, and yet one which may rightly give some concern as to the stamina of a people.
- (iii.) Environment. Philosophical historians have attempted to refer the peculiarities of national development to the physical characteristics of the country occupied by particular nations. The tracing of this influence of the physical environment upon the development of nations and communities is an important field for investigation, and by special study of particular countries it becomes possible to ascertain the influence of natural factors in determining the distribution of the population in a growing community, in directing the course of immigration, or in effacing national differences. All influences manifested in social institutions or customs, representing what may be called the social environment, have important bearing on and affect the life of man. As civilisation becomes more complex the number of these influences increases. It will be evident that we shall do well in this country, in which the British race is transplanted, and where new influences are at work, to watch with adequate attention the evolution of the people and to systematically study the development of the race both from the physical and psychical aspects.
- 5. Statistical and Administrative.—(i.) The Standardising of Statistical Data. From the standpoint of general statistics a census is indispensable. Vital statistics and records of production, transport, communication, trade, shipping, etc., derive their significance by being related to the population from which they have been derived. The census furnishes the necessary standard by means of which the statistical date respecting the community may be measured and compared, both among themselves and with corresponding data respecting other communities. To know the value of production in different industries without knowing the number, sex, and age of those engaged in such industries; to know the extent of trade without knowing the number of people represented therein; or to know the amount of the public debt without knowing the number of the population on whose behalf it has been incurred; would deprive our knowledge of the greater part of its value. The census therefore provides suitable norms or standards by means of which the extent and tendency of the varied activities of a community can be accurately gauged.
- (ii.) Financial. A knowledge of the number of the people is an essential also from the point of view of public finance. In the Commonwealth of Australia, where the relative populations of the several States formerly governed, to a slight extent, the allocation to them of Commonwealth revenue and expenditure, and now governs the whole amount paid per annum by the Commonwealth to the States, population statistics are essential. Up to the 30th June, 1910, all "new" expenditure of the Commonwealth was debited to the States on a per capita basis, and under the financial scheme, brought forward by the second Fisher Ministry, the populations of the several States were made the basis of allocation of Commonwealth subsidy. It is often necessary also to review proposed expenditures of public or other moneys in the light of actual or anticipated local populations.
- (iii.) Administrative. The machinery of administrative government, involving the provision for transport and communication, or for education, for police or other protection, or for any other of the many requirements of the community, has necessarily to be based upon an accurate knowledge of the extent and distribution of the population.
- (iv.) General. In addition to the objects and uses of the census thus far indicated, there are many others of minor importance. But enough has been said to shew that the modern census is an institution of great value; that the results obtained by it are essential for intelligent administration, and for the proper investigation of economic and sociological questions. In short, it is a sine qua non in a civilised country. Apart from its immediate utilities, the census furnishes the basis for that derivative analysis without which legislation and administration would be operations in the dark. It is this analysis that makes possible the review of a nation's affairs; which enables some estimate to be made of the success or failure of its administrative efforts; which discloses whether it is moving toward success or disaster. In short, without statistics based upon and corrected by census results, a satisfactory review of national affairs or a prognosis in regard thereto would be an impossibility.

#### SECTION 2.—METHODS OF ENUMERATION..

- 1. General.—The methods of enumeration may be classified (i.) according to the manner of determining the locality to which each person enumerated is to be credited, and (ii.) according to the method adopted for recording the population.
- 2. Manner of Determining the Locality of Population.—There are two modes of referring population to locality; one depending on domicile, the other upon actual location, at the time of the census. The former is known as a de jure enumeration, and the locality to which the person is assigned is ordinarily that in which he usually resides. The latter is known as a de facto enumeration, and refers each person to the locality in which he is residing at the date of the enumeration.
- (i.) Population de jure. In some countries only those persons are considered to belong to the population of a place who habitually reside therein. In countries where the number of regularly domiciled inhabitants determines many financial arrangements relating to the amount of payments to be made by and to a community, and also is the foundation on which numerous details of municipal and general administration are based, doubtless this definition of the term "population" is that which best answers practical purposes. It involves, however, a strict enumeration not only of persons temporarily absent, but also of strangers temporarily present. In France "la population de fait," which consists of all present in the district at a given time, is distinguished from "la population de droit," consisting of all usually resident in the district, inclusive of those temporarily absent, and exclusive of those only temporarily present; and also from "la population municipale," which is "la population de droit," less prisoners, inmates of hospitals, scholars resident in schools, members of convents, the army and navy.
- (ii.) Population de facto. The number of people actually present within the boundaries of a district at a given time form the "de facto" population, and it is this number which is counted by the Australian Census as well as by the censuses of the whole British Empire, except in Canada, where the "de jure" system has been adopted. All persons who are actually present in a place at the given moment, whether natives or foreigners, strangers or habitual residents, whether lodged in houses or ships, whether tramps, vagrants, or other houseless persons, are alike counted as units of the population. For the main purposes to which the census of Australia is subservient, this actual population is at present the more important to take into account.
- (iii.) Comparative Advantages of Enumerations de facto and de jure. The great advantages of enumerating the population de facto would appear to be on the score of simplicity, inasmuch as it only necessitates for any district a statement as to the number of persons who actually spent the census night in that district. On the other hand, the de jure system requires the exclusion of those temporarily present and the inclusion of those temporarily absent. In this connection it may be noted that it may be by no means easy to decide what should constitute temporary and what permanent residence in a locality, for example, in cases where a person has two or more residences and occupies each for a certain portion of the year.

The chief objections to the *de facto* method of enumeration are that under it visitors are included while temporary absentees are excluded, so that such places as watering places and health resorts may have their populations unduly inflated, while the districts from which the visitors to those places have come have their populations unduly diminished. To minimise these objections it is usual to fix the time for the census at an hour of the day and at a season of the year at which the displacement of population is a minimum.

It may here be noted that in the censuses of many European countries, e.g., Belgium, Germany, and France, the population de facto and de jure are both enumerated.

3. Methods of Recording the Population —As regards the responsibility for the original record of the number of persons living it may be broadly stated that there are two distinct methods of enumeration which may be respectively designated (i.) the Householder method and (ii.) the Canvasser method. Thus generally throughout the British Empire (with the exception of Ireland, Canada, India, Ceylon, and also a few other places of minor importance) the occupier of each "dwelling" is the person held primarily responsible for furnishing a written record of the desired particulars relative to the inmates of the "dwelling" occupied by him. The document in which he is required to fill in the desired particulars is known as the Householder's or Occupier's Schedule. In the United States of America, Ireland, Canada, India (except in the case of Europeans and natives of high rank), and Ceylon, however, the original entries are made by the enumerator as the result of inquiries instituted by him.

(i.) The Householder Method. This method has four important advantages, viz.:— Firstly, the liability of error is diminished; all statements resting on the householder's own authority, erroneous entries through hurry or carelessness in taking down the answers cannot occur.

Secondly, the time of the enumerator is saved and the cost is thereby reduced.

Thirdly, the labour of writing out the particulars is divided.

And fourthly, such division makes it possible for the particulars to be synchronous for all parts of the country.

The chief objection to the householder's schedule is that the accuracy of a census carried out through its agency is limited by the intelligence and literary capacity of the population to readily grasp the meaning and requirements of the blank forms and to fill them in properly. There are, of course, many countries in which, owing to the general illiteracy of the population, the householder's schedule cannot be used, and experience has shewn that people even fairly well educated find a considerable difficulty in thoroughly understanding a blank form, even when accompanied by copious explanatory notes, or by a supposititious example furnished for their guidance. Further, it frequently occurs that no proper attempt is made to comprehend the object or scope of the inquiries instituted in the schedule, the notes on which are not even read, while the whole matter is regarded as a somewhat irksome imposition, if not an inquisitorial impertinence. Comparatively few people adequately realise the enormous amount of preparation entailed by a general enumeration, the vast field of the inquiry, the amount of detail to be covered, and the importance of the results. The intelligence, co-operation, and good-will of the enumerated on the one hand, and of the enumerator on the other, are the links in the chain upon which the success of a census carried out by means of the householder's schedule largely depends.

(ii.) The Canvasser Method. If the householder's schedule could be made so simple in form that it would present no difficulty to the least intelligent householder, or if, on the other hand, the standard of intelligence could be raised so that the meaning and requirements of blank schedules could be readily grasped by all, there is no doubt that the householder method would be the best for universal adoption. The chief advantage of the canvasser method is that the difficulties due to ignorance and illiteracy of those enumerated are to a large extent obviated. The chief requirement for the success of this method is intelligence on the part of the enumerator, who should not only himself have a clear knowledge of what is required and how it should be recorded, but should also have the ability to readily obtain the desired information by means of questions well chosen and carefully asked.

The chief disadvantage of the canvasser method lies in the fact that the enumeration, owing to the time taken in obtaining the desired information, is not synchronous for the whole country, and thus it becomes difficult to avoid omissions and duplications due to changes of address, and also errors due to defective recollections of the fact as they existed on census day. In some countries special expedients have been adopted to reduce as much as possible the objectionable features of this method; for example, in India and Ceylon a preliminary canvass is made, followed by a final revision on census night.

- (iii.) Comparative Merits of the two Methods. A consideration of the various points in favour of and against the two methods of enumeration discussed above, leads to the conclusion that, in countries where both methods are equally practicable, a census involving only a few simple inquiries should be taken by the householder method, and that for more extensive inquiries a special canvass not connected with the general census should be made.
- (iv.) Enumerations of Uncivilised Communities. It has occasionally been found necessary to adopt special means of enumeration in a census of uncivilised or partially civilised races. Thus in the census of the natives of the Gold Coast in 1891, grains of Indian corn and cowrie shells were made use of for enumerative purposes, while in India bamboo sticks have been similarly employed. Another method which has at times been put into practice in enumerating some of the remote districts of India, has been that of taking a complete census of a few typical villages and obtaining an estimate for the whole district by taking into account the number of such villages. This method has also been suggested for use in estimating the population of some of the partially civilised parts of Africa.

Another special method which has sometimes been employed when the enumeration is recognised as very incomplete, is that of making an addition, either by way of percentage or otherwise, to the population enumerated to allow for those unrecorded. This, however, is open to considerable objection, inasmuch as ordinarily sufficient data, on which the number or percentage to be added can be based, do not exist. Such estimates are very unreliable, and in most cases are prejudiced by preconceived ideas of what the population ought to be.

4. The Form of the Schedule.—It must be admitted that to the uninitiated the sheet form of census schedule, with its numerous vertical columns and horizontal lines, with the closely-printed heading and elaborate hints and cautions, is likely to be a source of some perplexity, more particularly since the directions and notes furnished for the householder's guidance have not always been expressed in the simplest language or with the least ambiguous phraseology. A check on the particulars filled in by the householder is, however, ordinarily provided to some extent by requiring the collector to insert any missing, or correct or complete any obviously erroneous or deficient information.

- (i.) The Schedule in Sheet Form. The English method heretofore of presenting the various inquiries at the head of vertical columns has been adversely criticised as being less clear to the average householder than the method of placing the inquiries in the form of questions in the left-hand margin and reserving a vertical column for each person enumerated. The latter plan is followed in some countries, and though used in the United States Census of 1890 was discontinued in that of 1900, on the grounds of economy of space. It would, however, for purposes of convenience or lucidity appear to make little difference whether the subjects of inquiries are specified at the top of the vertical columns or at the side of the schedule.
- (ii.) The Individual Card or Schedule. What has been called the individual card or schedule, a modification of the "householder's schedule," has been adopted in most European countries, e.g., in France, Germany, Belgium, Italy. In these countries the householder is usually required to fill in a card or schedule containing certain general particulars relative to the household as a whole, and further to fill in for each member a separate card or schedule containing personal details. In the individual card the inquiries will naturally appear at the side rather than at the top. The use of a separate card for collecting the information from each person has many advantages. When the ordinary form of schedule is filled in by persons unused to such work the liability to error is considerable. With the personal card, on the other hand, each reply has to be written in contiguity to the question, and the chance of error is thus greatly reduced. The division of labour arising from the householder method of collection is, by the provision of personal cards, considerably extended, since each person in the household possessing the necessary ability can be entrusted with the filling in of his own personal card. This is a distinct advantage in the case of hotels, boarding-houses, etc. A further advantage arising in such cases from the use of personal cards, is that the only person in the hotel who need see the cards is the proprietor or manager, who is responsible for the collection in respect of the "dwelling" of which he is the "occupier." With a large schedule or number of schedules the particulars furnished by those entered early is often open for inspection by those entered later. This was necessarily the case where each person was asked to fill up the line relating to himself or herself. Another advantage of the use of personal cards for collection is that the information is at once available in a convenient form for any tabulation by hand sorting that it may be desired to make.

The advantages of the individual and householder's cards led to their adoption at this Commonwealth Census (1911); the form and requirements of the cards are referred to in detail in Chapter VI. hereof.

5. The Scope of the Census.—While naturally there is considerable similarity as regards some of the inquiries made in the census of the different countries of the world, there is a great variety both in detail and also, in some countries, as to the general scope of the census. Initially the Government of each country instituted such inquiries as seemed most suited to its requirements, but in later days much has been done by means of International Statistical and other Congresses to co-ordinate and unify the range and subjects of inquiry.

In Australia, as well as in the United Kingdom and the British Empire generally (with the exception of Canada), the practice of the census authorities is to ask for very few particulars and to concentrate their efforts on getting these with the greatest attainable accuracy, whereas in the United States, Canada and in Germany and certain other countries the ordinary schedules comprise a far greater number of particulars, while supplementary schedules are also used for special investigations. Generally speaking, all countries now enumerate the population according to age, sex, birthplace, conjugal condition, and occupation, while some (for example, in Cape Colony, Orange River Colony, and some of the Australasian colonies) have taken advantage of the occasion to collect agricultural and industrial statistics. Again, in other countries the scope of the inquiry is greatly extended, and by means of the census it is endeavoured to present an account of the national history during the intercensal period, and to sum up the effects of the vicissitudes of seasons, of religious and social movements, of educational effort, and of commercial and industrial progress. In India the conditions are entirely different to what they are in any other country, and the census methods employed in that Empire present very little resemblance to those adopted in most other parts of the British Dominions.<sup>1</sup> The census of Cevlon resembles that of India in many respects.

(i.) International Minimum. At the meeting of the International Statistical Institute, held in St. Petersburg in 1872, the following minimum requirements were agreed to :—(a) that the census should be nominal, (b) that it should enumerate "la population de fait," (c) that it should be decennial, (d) that it should be completed within 24 hours, (e) that the information to be obtained should include; i., the name of the individual; ii., his age; iii., his sex; iv., his relationship to the householder; v., his civil status; vi., his occupation; vii., his religion; viii., his language; ix., his education; x., his birthplace and nationality; xi., his residence; and xii., special mention of infirmities, such as blindness, deaf-mutism, cretinism, idiocy, and insanity.

<sup>&</sup>lt;sup>1</sup> See Modes of Census-taking in the British Dominions, R. H. Hooker, M.A. Journal of the Royal Statistical Society, Vol. LVII., p. 298.

(ii.) Development of the English and Australian Schedules. The progressive extension of the English schedule since 1801 is indicated in the tabular statement given below. For purposes of comparison the scope of the inquiries made at the censuses of New South Wales (the State in which the first Australian Census was taken) is also shewn:—

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FS.				ip to	tion,	ditio	of E.	Se.	ty.	iden ry.		нал	itati	ons.		d	Infir	nities.	ti-	on.	   <u>a</u> j	-Eq	ii ca u	.on.
Particulars	Name.	Age.	Sex.	Relationship to Head of Family.	Civil Condition.	Conjugal Condition.	Number of Children.	Birthplace.	Nationality	Length of Residence in Country.	Occupied.	Unoccupied.	Being Built.	Materials.	Number of Rooms.	Religion	Blind and Deafmutism.	Insanity or Idiocy.	Nature.	Grade.	Language.	Read and Write.	Attend School.	University.
									E	NGL.	AND	AN	ND .	WA	LES.	,								
1801 1811 1821 1831 1841 1851 1861 1871 1881 1891 1901	  X X X X X X X	X <sup>2</sup> X <sup>3</sup> X X X X X X X	X X X X X X X X X	X X X X X X		  X X X X X X	X14	 X X X X X X X X	    X		X X X X X X X X X <sup>7</sup> X <sup>7</sup>	X X X X X X X X X X	X X X X X X X X X		    X <sup>7</sup> X <sup>1</sup> 2		  X X X X X X X	   X X X X X X	X <sup>1</sup> X <sup>1</sup> X <sup>4</sup> X <sup>6</sup> X <sup>6</sup> X <sup>6</sup> X <sup>8</sup> X	X5 X8 X8 X8 X8 X8 X9 X10	X <sup>11</sup> X <sup>11</sup>			
1828 1833 1836 1841 1846 1851 1856 1861 1871 1881 1901 1911 24	X X X X X X X X X X X X	X15 X15 X15 X X X X X X X X X X	X	    X X X X X X X	X X X X X <sup>2</sup> X <sup>2</sup> 	UTI X X X X X X X X X X X X X	H W.	··· X X X X X X X X X X X X X X X X X X		X16 X16 X16 	X X X X X X X X X X X X X X X X X X X	whice X X X X X X X X X X X	ch fi	··· X X X X X X X X X X X X X X X X X X	Aust  X X X X X	X18 X18 X X X X X X X X X X X X X X X X	X X X X <sup>21</sup> X <sup>23</sup> X <sup>23</sup>			X20 X20 X20 		   X X X X X X X X	   X X X X X	   X X X X

Under three classes only (agriculture, trade, and others).
 Optional.
 Males above and under 20.
 For males over 20 only.
 In agriculture only.
 Rank, profession, or occupation.
 Number of rooms occupied if less than 5.
 Employers only specified.
 Employer, employed, or on own account.
 Homeworkers added.
 For Wales and County of Monmouth only; whether speaking Welsh only or English and Welsh.
 Number of rooms in dwelling.
 Includes also age at which person became afflicted.
 Includes also for each married woman number of years married.
 Under or over 12 years.
 For prisoners only.
 Sydney only.
 Protestants, Roman Catholics, Jews, or Pagans.
 Sexes not distinguished.
 Journeymen, apprentices, and assigned servants.
 Also incapacity for work through sickness or accident.
 Included relatives assisting on farms or stations, and unemployed.
 Included sickness, accident, and other infirmities.
 First Commonwealth Census.

It may be seen that each successive schedule has approached more closely to the standard suggested at the St. Petersburg meeting, but that for the census of 1911 the schedule for England and Wales, and in a lesser degree that for the Commonwealth, is still deficient in certain matters. In England there are no inquiries as to either religion or education, while the inquiries as to language and residence are only dealt with to a limited extent. In the Commonwealth there is no inquiry as to language, nor as to cretinism, idiocy, and insanity, but the card provides for certain additional inquiries not specified among the requirements agreed to at the St. Petersburg conference, viz., those as to (a) Date of existing marriage; (b) Number of children (living and dead) from existing marriage and from previous marriage; and (c) Period out of work (if for more than a week prior to census). The question as to profession or occupation is extended so as to include "grade" of occupation (i.e., whether employer; if in business on own account but not employing others for salary or wages; if assisting head of household but not receiving salary or wages; or if earning salary or wages); and also occupation of employer (if any).

6. **Methods of Tabulation.**—The method of tabulation adopted in the Census Office of England and Wales, prior to the Census of 1911, for dealing with the data obtained by the enumeration was as follows:—When returned by the householders, the schedules were copied by the enumerators into enumeration books; these were sent to the Registrar for the sub-district. After examination and revision by the Registrar a fresh summary was made out for the whole

sub-district from the enumeration books.<sup>1</sup> These summaries were sent to the Census Office and used for obtaining district, county, and other totals for the preliminary census. The different facts contained in the enumeration books were afterwards transferred to tabulation sheets of different kinds—one for ages and civil condition, others for birthplaces, occupations, infirmities, and so forth.<sup>2</sup> The tabulation sheets contained various compartments for the particulars as given in the final printed volumes.

According to this system, therefore, the facts were rearranged in written schedules. There are, however, two other methods of tabulation in use, viz.—(i.) The Card or Slip system. (ii.) Mechanical tabulation.

- (i.) The Card System.<sup>3</sup> This system has been used in connection with the censuses of the Australasian Colonies,<sup>4</sup> India,<sup>5</sup> Ceylon,<sup>5</sup> the South African Colonies,<sup>6</sup> and of a number of European countries. In the classification of policies for the purpose of actuarial valuations by Life Insurance Companies, the use of cards has long since supplanted the older system of classification on written schedules. By their use the subdivision into the necessary groups and ages is rendered much simpler, and a considerable saving of time and labour is effected. The use of cards or slips in connection with the tabulation of census results is said to have been first successfully employed by Professor von Mayr in the Bavarian Census of 1871,7 and has since been extended with complete success to the censuses of many other countries. size of the cards or slips used may naturally vary according to the extent of the information furnished by the population schedules. Each card is devoted to a single individual, the whole number of cards used corresponding therefore to the whole population. On each card all the particulars to be tabulated concerning each individual are copied from the schedules. In some cases the card is divided into a number of chief divisions corresponding to the subjects of inquiry. Each of these chief divisions is then divided into a number of compartments, each compartment corresponding to one of the several particulars under which it is desired to tabulate the various subjects of inquiry. The copying of each particular from the schedule on to the card is done by simply drawing a bar across the compartment corresponding to the particular which it is desired to enter for the individual concerned. In the cards used in other countries, spaces are provided for each of the chief subjects of inquiry, and the necessary particulars are filled in by hand, abbreviations being, of course, extensively used. When the cards are all filled up, the work of tabulation is performed by simply sorting the cards under any given head or heads and counting them. When another branch of the census statistics forms the subject of inquiry the cards are re-sorted under that head, and so on until the whole of the recorded items have been abstracted. In general, cards of different colour are used to indicate the more important divisions, such as sex and civil condition, the tabulation under these important divisions per se being thus carried out by simply counting the cards of different colours.
- (ii.) Tabulation from the Individual Schedule. It may be noted that in countries where the individual "schedule" (see par. 4 of the present section) is used, there is no necessity for the particulars for each individual to be copied on to cards, the schedules themselves being used as cards for the purposes of tabulation. A considerable saving of time, labour, and money is thereby effected.

This method of tabulation was adopted in connection with the present Commonwealth Census. As will appear hereinafter, the use of mechanical tabulating and sorting machinery necessitates the preliminary punching of a special card for each individual. Delay is thus caused in the tabulation of the census results, and although it would appear that the cost of tabulation is reduced by the use of mechanical devices, the early publication of the more important census results was considered, after due deliberation, to be in Australia of paramount importance. Many of the devices are still only in the experimental stages, and do not appear suitable without considerable modification for the purpose of the census of this country. It may also be added that the advantages of adopting mechanical tabulators are less striking in a country like Australia, where the population is not very large, and where the combinations required are not of a very elaborate nature, than they are in the United States, where the population is large and where the opportunity is taken of collecting at the census a large amount of industrial statistics.

(iii.) Electrical Tabulators. During the work of the tenth census—that of the year 1880—of the United States of America, Dr. Herman Hollerith saw the need of adopting a mechanical method for tabulating population and similar statistics.<sup>8</sup> The Hollerith

¹ See Census Report, England and Wales, 1901, p. 8. ² See The Case for Census Reform. G. H. Ryan, F.I.A., Journal of the Institute of Actuaries. Vol. XXXVI., p. 348. ³ Probably first used for statistical purposes by Mr. A. G. Finlaison, of the National Debt Office, London, in 1852. ⁴ First used in Australia for census purposes in the Victorian Census of 1881, taken by Mr H. H. Hayter. ⁵ In 1901. ⁶ In 1904. ⁻ See Census Report, India, 1901, Vol. I., p. XXII., where a brief account of the system as used in Bavaria in 1871 is given. ⁶ See The Electrical Tabulating Machine. Dr. Herman Hollerith, Journal of the Royal Statistical Society, Vol. LVII., p. 678, where a fairly full description of the machine is given. Various important improvements have been made in the machine since that paper was written (1894).

system of electrical tabulation may be best described as a mechanical development of the card system of tabulation. The cards are prepared by punching holes in them, the relative positions of such holes defining the individual responses to the questions asked. In the United States Census of 1890 the cards used were 34 inches by 65 inches, their surfaces being divided into 288 imaginary spaces, each ¼ inch square. To each of these spaces some particular value or meaning was assigned; thus a hole in one place may mean a white person, in another a black, or again, one hole may indicate a certain age group, and another gives the exact year in that group. A combination of two holes in another part of the card indicates the occupation of the particular individual. In this way at the United States Census of 1890 answers were recorded not only to the twenty-six inquiries contained in the population schedule, but the particular State, county, city, and enumeration district in which each individual resided were also recorded. The punching of the cards was carried out by means of a special "keyboard" punch, and a "gang" punch, the latter being used for making the same combination of holes in all the cards of a given district. Having thus prepared a punched transcript for each individual, the cards are tabulated on the electrical machine, the main features of which are described by Dr. Hollerith, as follows:—" The machine consists primarily of a press or circuitclosing device, the upper and movable portion of which is provided with projecting spring-actuated needles or points corresponding in number and relative position to the holes which may possibly be punched in the record card. The lower or fixed plate consists of a piece of hard rubber provided with a corresponding number of cups partially filled with mercury, which through suitable wires are connected with the binding posts of the switchboard. If a punched card is placed in the bed and the handle depressed, wherever there is a hole in the card, the needle will dip down into the mercury, while at all other points the needles will be pressed back. Counters are used, and consist of electro-magnets so arranged that each time a circuit is closed through it the armature is actuated so as to register unity. Combinations of groups are secured by a simple use of the well-known electrical relay.

In the year 1901, towards the close of the work of tabulation of the twelfth census of the United States, the Hollerith machine was improved by the addition of automatic feeders, by means of which punched cards placed in a receiver in lots of 400 or 500 were automatically tabulated. A further improvement consists in a device whereby cards which pass through the machine without being tabulated fall into what is known as the reject box, for further examination.

The average speed of the Hollerith machine at the United States Census of 1900 was 80,000 to 90,000 cards in a working day of seven hours, including stoppages for reading dials.<sup>1</sup>

Modifications of the Hollerith electrical tabulator have been made in Austria, Japan, and Switzerland.

The question of the adoption of electrical tabulators at the present (1911) census of the Commonwealth has already been referred to. (See (ii.) above).

- (iv.) The Automatic Sorter. This machine was first used in connection with the United States Census of 1900. As in the Hollerith machine, the cards are fed downward one by one. The circuit established through holes in the cards by means of electric magnets controls ten chutes of varying lengths leading to ten boxes. As each card is pushed downward it enters the chute which has been determined by the electro-magnet as the proper one to receive it, and is assisted by fingers into its proper receptacle. In this way cards which have been placed in the feeder box pass through the machine, and are deposited in one or other of the ten boxes, according to the combinations which have been worked out previously by the adjustment of pins in the box. The separation of cards into not more than ten classes requires but one run through this machine; any number of classes exceeding ten requires two or more runs. If a card is imperfect the machine does not advance it, but passes it into a reject box. The automatic sorting machine can be operated at a speed of from 75,000 to 175,000 cards per day.
- (v.) The Automatic Sorter and Counter. At the suggestion of the Commonwealth Statistician, counting mechanisms have been added to the automatic sorter, so that the cards may be counted at the same time as they are sorted.
- (vi.) The Classicompteur Imprimeur. This machine may be used for arranging schedules in different classes, and for counting the number in each class. It consists essentially of a horizontal table carrying an inclined keyboard, of which the keys operate the counters. The results are printed by depressing a lever. The machine thus permits of the direct examination of the schedules without preliminary transcription on to special cards.
- 7. Intercensal Periods.—General experience and practice point to the unanimous conclusion that the interval from census to census should in no case be greater than ten years. Considerations of expense have in the majority of cases prevented the census from being taken

<sup>&</sup>lt;sup>1</sup> See American Census-taking. Hon. W. R. Merriman, 1903, p. 22.
<sup>2</sup> See American Census-taking Hon. W. R. Merriman, 1903, pp. 22-3.

at shorter intervals, but for many years an agitation for reducing the period from ten to five years has been more or less vigorously carried on. The following statement has been prepared in order to show the intercensal periods in the more important countries according to their present practice:—

Country.	Period- icity.	Year in which present ar- rangements com- menced.	Country.	Period- icity.	Year in which present arrangements commenced.
I. United Kingdom and Ireland	10	1801	3. Continent of Europe.	!	
England, Scotland, and Wales	10 years	1801	Austria	10 years	1880
Ireland	10 ,,	1911	Belgium <sup>6</sup>	10 ,,	1856
2. British Possessions, etc.	1	!	Denmark	5 ,,	1901
D. 1. T.1	10	1891	France <sup>7</sup>	5 ,,	1821
0 1	10 "	1871	Germany	5 ,,	1875
	10 "	1891	Greece	Varies.	
Cape Colony <sup>1</sup>	"	1891	Italy	10 years	1861
Ceylon	10 "	1881	Netherlands	10 ,,	1829
Hong-Kong <sup>2</sup> India	10 "	1881	Norway	10 ,,	1900
3.5	10 "	1851	Portugal	Varies.	
	10 "	1891	Russia <sup>8</sup>		
27 4 11 1	"	1891	Spain	10 years	1900
A .1 TTT 1	"	1891	Sweden	10 ,,	1860
27 77 1 1	-5 "	1861	Switzerland <sup>9</sup>	10	1860
1.0,, 2.0,	10 "	1881	1.5		
Orange River Colony <sup>3</sup>	77	1880			İ
Queensland4		1891			1
South Australia	10 "	,	4. America.	ļ	!
Tasmania		1861			
Transvaal <sup>5</sup>	10	1001	TT-:4-d States	10	1700
Victoria		1861	United States	10 ,,	1790
West Australia	10 ,,	1881	Mexico	10 ,,	1900

<sup>1.</sup> The census proposed for 1901 was abandoned owing to abnormal conditions created by military operations; a census was taken in 1904 and in 1911. 2. An intermediate census was taken in 1897. 3. Censuses taken in 1890, 1904, and 1911; see also note 1 hereof. 4. An Act of 1875 provided for a quinquennial census; this was held in abeyance in 1896 and 1906. 5. Censuses taken in 1890, 1904, and 1911; see also footnote 1 hereof. 6. Since 1880 the decennial census has been taken in the last year of the decade. 7 Owing to the Franco-Prussian War the census due in 1871 was taken in 1872. 8. First complete census taken in 1897; none taken since. 9. Census taken in 1888 instead of 1890.

- (i.) The Question of a Quinquennial Census. The above analysis shews a marked preference for the decennial period according to present practice. It may be seen, however, that the quinquennial period is adopted by such important countries as France, Germany, Denmark, and New Zealand. The United Kingdom has worked under a decennial census for over a century, but the administrative County of London (under the Equalisation of Rates Act, 1894) makes an intermediate enumeration, thus adopting the principle and practice of quinquennial censuses. Since the middle of the nineteenth century an agitation for reducing the intercensal period in the United Kingdom from ten to five years has been more or less vigorously carried on. The Royal Statistical Society, the Institute of Actuaries, and the Census Committee of 1890 have made various representations to the Government with this end in view. In this connection the following paragraph taken from the General Report on the Census of Western Australia in 1891 is of interest:—"Should the federation of the Australian Colonies become an established fact, . . . . it may be taken for granted that a quinquennial census under federal direction will become an absolute necessity as far as Australia is concerned, while the principal British Statists appear to be unanimously in favour of the population of the United Kingdom being enumerated every five years."
- (ii.) The Advantages of a Quinquennial Census. Perhaps the chief argument in favour of a quinquennial census is its desirability as a basis for the more correct calculation of birth rates and death rates. In all such computations in the interval between two successive censuses, it is obviously necessary to interpolate corresponding values for the population, and though the error in the interpolated value for the total population of a country may be small, experience has shewn that estimates as to the local distribution of population are erroneous and misleading. The changes in industrial conditions brought about by opening up new districts to settlement, by new inventions, and by improved facilities of transport and communication, are now far more rapid than formerly, especially in a new country like Australia; so rapid that there is an unquestionable want of more frequent information than is furnished by a decennial census. Further, in many countries population is recognised as a basis for representative and administrative purposes both with regard to the general and local government systems, whereas under

<sup>&</sup>lt;sup>1</sup> See The Case for Census Reform. G. H. Ryan, F.I.A., Journal of the Institute of Actuaries, Vol. XXXVI., p. 334. <sup>2</sup> See Studies in Statistics, Longstaff, p. 202.

existing arrangements a few years after the taking of a census estimates of the local distribution of the population are likely to be misleading. Thus in Australia the numerical representation of the several States in the Commonwealth House of Representatives is based upon their respective populations, and the actions of the State Government are in certain respects largely governed by considerations of the local distribution of population, as, for instance, in the extension of railway and educational facilities, and in determining the amounts of grants to be made to local authorities. In addition, the amount and the allocation to the States of Australia of the annual subsidy from the Commonwealth Government is based upon the estimated number of people in the respective States at the middle of the financial year (Dec. 31st). With so long an interval as 10 years between censuses marked inaccuracies in the estimates are possible, and consequently a check count at least once in five years is desirable. For general statistical purposes, moreover, a census more frequent than every ten years is very desirable. The figures with which the statistician deals are always related either directly or indirectly to population, so that it is of paramount importance that the populations of the countries and districts concerned should be known. Another advantage of a more frequent census would be that the people enumerated would come to regard the census as an ordinary occurrence, and would learn to appreciate its utility and importance in the common good. If people had to return their ages more frequently, there would be a strong tendency towards more truthful statements; they would become more accustomed to the inquiry, some of the glaring misstatements would be avoided through a fear that the previous return might be remembered, and the margin of error would be reduced.1 A further reason for taking the census more frequently is that the experience gained by those employed on the duty is in a large measure lost when so long a period as ten years elapses between each enumeration.

(iii.) The Objections to Quinquennial Census. The only objection to the introduction of the quinquennial census would appear to be on the score of expense. The total cost of the Commonwealth Census of 1911 may be put down approximately as £175,000. At the outside, therefore, a further equal amount would need to be charged upon the revenues of a period of ten years. The maximum increased annual cost of a quinquennial census in Australia would therefore be about £17,500, a sum that would make but little difference in the £50,000,000 which in the financial year 1910-11 represented the normal national expenditure of the Commonwealth and State Governments. In at least two important directions, however, this cost would be materially reduced—(a) by restricting the facts to be elicited at the intermediate censuses to numbers, age, and sex, and (b) by reason that the special census staff, which has now to be reorganised and drilled anew once every ten years, would become better acquainted with their duties and would carry them out more rapidly and efficiently, with a corresponding saving in The intermediate quinquennial census would also offer a favourable opportunity for the introduction of an Industrial Census, which would enable matters of the utmost importance in Australia to be opened up to further inquiry and investigation, such matters, for instance, as the development and economic condition of the agricultural, pastoral, dairying, manufacturing, and mining industries; the extent of employment and earnings in various industries; the cost of living of various social and industrial classes; and the wealth of the people and its distribution among the classes.

<sup>&</sup>lt;sup>1</sup> See The Case for Census Reform, G. H. Ryan, F.I.A. Journal of the Institute of Actuaries. Vol. XXXVI., p. 336.

#### CHAPTER III.

#### CENSUSES OF MODERN TIMES.

#### SECTION 1.—GREAT BRITAIN AND IRELAND.

- 1. England and Wales.¹—Prior to the commencement of the nineteenth century, no direct method had been adopted to enumerate the population of England. Various estimates of the population had, however, been formed at previous periods, based upon the Domesday Book, Subsidy Rolls, and payments of Hearth and Poll taxes, but they involved of necessity so large an intermixture of guesswork as to greatly diminish the value of their results.
- (i.) First Proposal for Systematic Enumeration, 1753. No proposal to ascertain the population of England and Wales by systematic enumeration appears to have been made until the middle of the 18th century. On the 30th March, 1753, Mr. Thomas Potter, M.P., introduced a Bill "for taking and registering an annual account of the total number of the people, and of the total number of marriages, births, and deaths; and also of the total number of the poor receiving alms. . . . . "This measure met with violent opposition in certain quarters and called forth denunciations and prophecies of an extraordinary and virulent nature, and, although successful in passing through all its stages in the House of Commons, was eventually thrown out in the House of Lords.
- (ii.) First Census, 1801. Nearly half a century elapsed before the proposal was renewed. In 1800 a Census Act (41 Geo. III., 31st Dec., 1800) was passed through all its stages without opposition, this change in public opinion being probably attributable to some extent to the fear that the people were increasing so rapidly as to outstrip the means of subsistence. This alarm was accentuated by the great dearth which prevailed in the country at the time when the Bill was brought forward, and also by the attention excited by the publication of Malthus' essay "On Population," which first appeared anonymously in 1798. The census provided for by the Act of 1800 was taken on the 10th March, 1801, when England and Wales were found to contain 8,892,536 and Scotland 1,608,420 inhabitants. The census of 1801 did not extend to Ireland.
- (iii.) Censuses, 1801 to 1831.<sup>2</sup> The census of 1801 has been followed by enumerations made decennially in the first year of each decade. The important work of census-taking has, strange to say, not yet been recognised by the British Legislature as being of a permanent character, and consequently, a special authorising Act has to be passed for each census.

The first four censuses of England and Wales were taken by the agency of the overseers of the poor, or of substantial householders in each parish or place, and the results were abstracted under the superintendence of Mr. Rickman, Assistant Clerk to the House of Commons. These censuses differed but little from each other as regards both the scope and machinery of the inquiry.

- (a) Method of Collection. The overseers collected information concerning the inhabitants of their respective parishes by personal inquiry, and, on the basis of the information thus collected, framed answers to printed questions addressed to them concerning the numbers and occupations of the persons living in their parishes.
- (b) Scope of Inquiry. The principal population inquiries were those relating to (1) Families; (2) Sexes; and (3) Occupations.

A list of questions was transmitted to the overseers of the poor or a substantial householder<sup>3</sup> in "every Parish, Township, and Place," and such overseers and householders were required to take the necessary steps for obtaining answers thereto. In 1801 each overseer was required to furnish for his district the number of families, the number of persons of each sex, exclusive of soldiers and seamen, the number of houses inhabited and uninhabited, and the number of persons employed in (a) Agriculture, (b) Trades, Manufactures, or Handicraft, or (c) neither of the foregoing. In 1811 the Occupation inquiry was amended and was made to relate to families instead of persons, while the number of houses being built was also included. At the census of 1821 provision was for the first time made for a record of ages in groups. It

<sup>&</sup>lt;sup>1</sup> See Census Report, England and Wales, 1881; also "Some Account of the Census from 1801 to 1881" by A. F. Burridge, F.I.A. Journal of the Institute of Actuaries, Vol. XXV., p. 83. <sup>2</sup> See Census of Great Britain, 1851, Vol. I., Population Tables, pp. ix. and x. <sup>3</sup> The whole of the country had not been placed under the Poor Law Acts.

was, however, optional for the overseer to make the inquiry, and it was also optional for the person enumerated to furnish a reply. At the census of 1831 the number of questions addressed to the overseers was increased from seven to sixteen; the Occupation inquiry was considerably extended, but the detailed enumeration of ages was dropped, the only age particulars ascertained being the number of males aged upwards of 20 years engaged in each of the seven groups of occupations specified. The areas of the parishes were given for the first time at the census of 1831.

(iv.) Present System Introduced, 1841. In the year 1840 a lengthy report was issued by a Committee of the Statistical Society of London (now the Royal Statistical Society), appointed for the purpose of considering the best mode of taking the census of the United Kingdom in This Committee, after reviewing the census methods adopted by the leading European countries, and in the United States, recommended that the statutory co-operation of the Poor Law Commissioners and of the Registrar-General appeared to be essential to the proper conduct of the census of 1841. The Committee also recommended that the system of enumeration by names, as pursued at the Irish Censuses of 1821 and 1831, and not by mere marks, was of great importance in order to obtain "security against fallacious returns." The subjects of inquiry suggested by the Committee were as follows: (a) age, (b) sex, (c) unmarried, married, or widowed, (d) occupations, (e) place of birth, (f) religious persuasion, and (g) healthy, sick, or permanently infirm. The Committee also recommended that the work of actual enumeration should be carried out in rural districts by the entry in books at each house of the particulars concerning its inmates, but that in the towns, the method then pursued in Belgium of circulating householder's schedules in the form of queries to the master of each house should be adopted. Seven queries were suggested, each relating to one of the suggested subjects of inquiry. The recommendations of this Committee were to a large extent adopted at the census of 1841, and in many respects they now form the basis of census methods both in the United Kingdom and Australia, as well as many other parts of the British Empire.

The Registration (Births, Deaths, and Marriages) Act had come into force in 1837; and for the purposes of this Act, the whole country had been mapped out into a number of districts, each with a superintendent registrar, and these districts again subdivided into sub-districts, each with a resident registrar, whose duty it was to keep account of the births and deaths in his sub-district; while, presiding over the whole system, was the Registrar-General with a staff of assistants in London. It was obvious that such an organisation as this was well adapted to furnish the framework of the machinery for the work of enumeration, and the business was therefore taken out of the hands of the parochial overseers and entrusted to the new body of local registrars.<sup>2</sup>

- (a) The Occupiers' Schedules. Other important alterations were also introduced at the census of 1841. The age inquiry was reintroduced, the birthplaces were recorded, and the occupations were all arranged, according to the householder's statement, alphabetically. A very important change was also made in the method of enumeration, the submission of a list of questions to overseers, etc., being discarded in favour of Occupiers' Schedules, in which the desired particulars were entered by the occupier himself with regard to all persons present in his house on a certain fixed night. Each person was specified by name, so that this was the first "nominal" census taken in England.
- (b) Collection and Compilation. The schedules were distributed and collected by special enumerators, each registrar's sub-district being parcelled out by him for that purpose. At the first four censuses each overseer was required to classify and summarise the information collected by him, returning in his report simply the numerical results for his district. At the 1841 and subsequent censuses, however, all compilation and tabulation was carried out at the Head Office, thereby securing greater uniformity than had been hitherto obtainable.
- (v.) The Census of 1851. The method of enumeration introduced at the census of 1841 was found to answer so well that it has been continued on each subsequent occasion without material alteration. A report, issued by the Census (1851) Committee of the Statistical Society in 1850, approved generally of the adoption, at the census of 1851, of the methods used in 1841.<sup>3</sup> The system has, however, been amplified and amended in certain minor respects. The census of 1851 exhibited statistics not only of parishes and parliamentary and municipal boroughs, but also of all important large towns and ecclesiastical districts and parishes.<sup>4</sup> In addition to the subjects of inquiry previously included in the schedule of 1841, it was determined to ascertain various relationships (such as husband, wife, son, daughter), the conjugal condition (as married, unmarried, widow, etc.), and the number of persons blind, deaf, or dumb. Two collateral branches of inquiry were prosecuted in 1851 by means of the census machinery, but not under the compulsory powers of the statute; these related to (a) the provision existing for religious worship, (b) the means existing for education, and the attendance at churches and schools.

See Journal of the Statistical Society of London, Vol. III., pp. 72 to 102.
 See General Report, Census, 1881, Vol. IV.
 See Journal of the Statistical Society, Vol. XIII., pp. 268-70.
 See Report of Commissioners of Census of United Kingdom, 1851.

In 1851, Dr. Farr introduced a classification in which the occupations were divided into six classes, containing eighteen orders. This principle has, with some modifications and extensions, been since maintained, and in the classification used at the present Commonwealth Census there are now eight classes, and twenty-seven orders.

- (vi.) The Census of 1861. In 1861 the census of Scotland, which had always previously been provided for in the same Act as that of England and Wales, was arranged for in a separate This practice was continued until 1901, when the original method of legislating for the whole of Great Britain in the same Act was reverted to. The census of 1861 distinguished sex, age, conjugal condition, relation to head of family, profession, and birthplace. The collateral inquiries as to religion and education were dropped. The census of Ireland has always been the subject of separate legislation.
- (vii.) The Census of 1871. The census taken on the 3rd April, 1871, marked an important extension of the system, since on that occasion, for the first time, an attempt was made to enumerate the population of the whole of the British Possessions. It should be noted, however, that this census was by no means synchronous throughout the Empire; in Western Australia and Tasmania the census was taken in 1870, while the enumeration was not synchronous either for the whole of the Indian Empire or for the Dominion of Canada. The Census (1871) Committee of the Statistical Society reported in 1870 that it was not desirable to depart from the arrangements made at previous censuses, but recommended that the inquiries made at the census of 1851 into (a) the provision existing for religious worship and the attendance thereon, and (b) the means existing for education and the attendance at schools and places of instruction, should be reintroduced. Those recommendations, however, were not adopted.<sup>1</sup>

The total number of persons in the British Empire enumerated in 1871 was 234,802,593, of which number 31,484,661 were in the United Kingdom, and 191,307,070 in British India. The number of registration districts in England and Wales for the census of 1871 was 626. The important development of the census of 1871 opened the way for fresh ranges of inquiry, by which questions of great importance could be approached. Materials were furnished for ascertaining the relative growth of different colonies—their progress by immigration or natural increase—and rates of mortality in different parts of the Empire could be compared.

(viii.) Later Censuses. Since the year 1871, simultaneous censuses of the various portions of the British Empire have been taken in 1881, 1891, 1901, and 1911, and in England and Wales the system in force at the census of 1871 has not since been materially departed from. population of the British Empire recorded at the Census of 1901 was 398,401,704, while that enumerated at the census of 1911 exceeded 420,000,000.

Particulars have already been given in tabular form as to the progressive development of the English schedule. (See p. 14 hereinbefore.)

- (ix.) Reports on Censuses by Committees of Royal Statistical Society. In 1879 a committee was appointed by the Council of the Statistical Society of London for the purpose of considering whether advantageous suggestions as regards improvements in the inquiries or machinery connected with the census of 1881 could be made. The more important recommendations of this Committee were as follow
  - (a) That the same form of schedule should be adopted in all parts of the United Kingdom.
  - (b) That additional subjects of inquiry should include "religious profession" and "number of rooms in each dwelling house," and
    (c) That the classification of houses and the inquiry as to birthplaces be extended.

The Committee also expressed an opinion that it was desirable, for a variety of purposes, that the census should be taken quinquennially.2 The only one of these recommendations adopted was that dealing with the inquiry as to "birthplaces."

In 1888 another Committee appointed by the Council of the Royal Statistical Society with reference to the census of 1891, submitted a report<sup>3</sup> recommending that a permanent Act should be passed for a quinquennial census, and that a separate and permanent Census Office should be created. At the 1891 census of England and Wales particulars were included as to whether employer, employee, or neither, and as to the number of rooms occupied if less than five. Otherwise the schedule was identical with that used at the previous census. The taking of a census in the United Kingdom limited to number, age, and sex, midway between the decennial periods, and the establishment of a permanent census staff were further urged in a memorial and by a deputation4 from the Royal Statistical Society to the President of the Local Government Board in 1894.

A further Committee of the Royal Statistical Society reported in 18975 with reference to the proposed universal census of 1900 that the following five facts were all that should be insisted on for uniform treatment:—(a) Number of de facto population. (b) Sex. (c) Age—the first 5 years separately, the rest in quinquennial periods, distinguishing the sexes. (d) Conjugal condition—as single, married, widowed, combined with sex and age. (e) Birthplace.

 $<sup>^1</sup>$  See Journal of the Statistical Society, Vol. XXXIII., p. 113.  $^2$  See *Ibid*, Vol. XLIII., p. 134. *Ibid.*, Vol. LI., p. 816.  $^4$  See *Ibid*, Vol. LVII., pp. 379-83.  $^5$  See *Ibid.*, Vol. LX., p. 162. <sup>3</sup> See

report was furnished by this Committee in 1899, making several recommendations as to alterations in the schedules and especially with a view to attaining uniformity of the schedules throughout the United Kingdom.¹ The majority of these recommendations were adopted by Parliament and incorporated in the Census Act, 1900. An unsuccessful attempt was made in 1900 to obtain the insertion in the Census Act of that year of a clause providing for an interim census in 1906, and again, in 1904, a deputation (representing the Royal Statistical Society, the Institute of Actuaries, the Society of Medical Officers of Health, and the British Medical Association) to the President of the Local Government Board unsuccessfully urged the establishment of a quinquennial census of a limited character, viz., dealing with numbers, sex, and age only.²

In September, 1908, the first report of the Census (1911) Committee of the Royal Statistical Society was issued.<sup>3</sup> This report dealt with questions which were considered urgent in connection with the preparatory work. The second report, adopted in April, 1909, contained recommendations as to the form in which the final results of the census should be exhibited, together with proposals regarding an organised enumeration of the Empire. The first part of the final report<sup>4</sup> was divided into three sections dealing respectively with (i.) Schedule, etc., (ii.) Tabulation, and (iii.) A permanent Census Office. The second part of the report dealt with the question of an Imperial Census.

- I. (i.) Schedule, etc. The Committee recommended (a) that an Act should be passed providing for a general census to be taken every ten years, and for an enumeration by sex and age every intervening fifth year; (b) that the schedule should be uniform throughout the United Kingdom as to the main subjects of inquiry; (c) that in the inquiry as to Conjugal Condition, the condition of "divorced" should be recognised; (d) that an optional inquiry as to religion should be instituted; (e) that the inquiries as to occupation and birthplace be extended; and (f) that the inquiry as to infirmities should be amended. A draft of the schedule headings and instructions, in which the above recommendations were embodied was appended to the report.
  - (ii.) Tabulation. The recommendations of the Committee as to the form in which the results of the census should be finally exhibited comprise the additions consequent upon the suggestions regarding the schedule, together with such modifications of the tables of the last census as were held to be statistically desirable. With regard to the classification of occupations the Committee suggested, with a view to an Imperial compilation, that the returns should be adapted so as to permit of a scheme of tabulation such as is found amongst the Australian returns of 1901.
  - (iii.) A Permanent Census Office. The advantages of a permanent establishment to deal with work connected with the census were again referred to, and the establishment of a Census Commission was recommended.
- II. Imperial Census. The Committee held that uniformity in the schedule or scope of the inquiry throughout the Empire is no more attainable or necessary than in the actual date of the enumeration. It was pointed out, however, that it is desirable that the States of South Africa should bring their operations into line with those of other parts of the Empire, and also that the census should not be again allowed to lapse in those West Indian Colonies where none was taken in 1901. The Committee were of opinion that the subjects to which Imperial comparison can be most usefully directed are:—

  (a) Sex; (b) Age; (c) Conjugal Condition; (d) Birthplace; and (e) Occupation.
- 2. Scotland.—The earliest census in Scotland was taken in 1801 in conjunction with the first census of England and Wales. The actual work of collection was, however, and has subsequently been, quite distinct from that of England and Wales, and has been controlled by specially appointed census authorities in Edinburgh. In Scotland the method was adopted of employing the parish schoolmasters to perform the local duty of enumerating the population in the country districts. As previously pointed out, provisions for the censu of Scotland were, from 1801 to 1851 inclusive, contained in the same Act as those for the census of England and Wales, while from 1861 to 1891 inclusive, separate legislation was passed for the two divisions. In 1901 the original method of including all the provisions for the census of Great Britain in one Act was reverted to.
- (i.) Census of 1861. In Scotland there having been no such organisation of registrar's districts as had been effected in England in 1837, the important administrative changes in the 1841 census of England could not be adopted at the 1841 census of Scotland.<sup>5</sup> The Registration Act for Scotland came into force, however, on the 1st January, 1855, and the census of 1861 was made under the superintendence of the Registrar-General for Scotland through the agency of 1001 local registrars, and 8075 enumerators. At this census the population of Scotland

<sup>&</sup>lt;sup>1</sup> See Journal of the Royal Statistical Society, Vol. LXII., pp. 679-81. <sup>2</sup> See *Ibid*, Vol. LXVII., pp. 272-81. <sup>3</sup> See *Ibid*, Vol., LXXII., pp. 496-8. <sup>4</sup> See *Ibid*, Vol. LXXII., pp. 574-593. <sup>5</sup> See *Ibid*, Vol. III., p. 96.

- was 3,062,294. The forms and instructions issued were all based on, and in most cases virtually the same as, those used in England in the census of 1851. Other features of the census of Scotland of 1861 were the tabulation of particulars relative to the number of families in every parish and county, to the number of dwellings having windows, and to the number of children between the ages 5 and 13 in attendance at school.
- (ii.) Census of 1871. The returns of this census for Scotland contained some new features, such as the ecclesiastical subdivision of civil counties, grouping the population into three great divisions according as they inhabited towns, villages, or rural parts, and returns as to houses, families, and population in parliamentary constituencies.
- (iii.) Later Censuses. The census of 1891 introduced additional inquiries as to the number of (1) Employers, (2) Employed, (3) Workers on their own account, and (4) others of whom no statement is made. The schedules used in recent censuses have been substantially the same as those used in England and Wales.
- 3. Ireland.—Prior to the inauguration of periodical census-taking in Ireland, several population estimates had been made at various times, the earliest on record being that of Sir William Petty in 1672. Another estimate, concerning which brief particulars appear in the transactions of the Royal Society of London, was made in 1695 by Captain South. Again, during the eighteenth century, numerous estimates of a more or less trustworthy nature were made on the basis of the number of houses returned by the Hearth-money Collectors, while in 1731 an inquiry was instituted by order of the House of Lords of Ireland for ascertaining the population through the medium of the Magistracy and the Established Clergy. In 1805 Major Newenham published an estimate of the population in the preparation of which he had endeavoured to correct the inaccuracies of the Hearth-money returns.
- (i.) Early Censuses. The first attempt at a general census was made in 1811, but it was decidedly unsuccessful. It was repeated in 1821, but went no further than a bare enumeration. The census of 1821 was taken under the Population Act, 1815 by which the duty of superintending the general management of the proceedings throughout the counties was transferred from the grand juries to the bench of magistrates assembled at sessions. The census taken in 1831 was subjected to correction in 1834, to make it the basis of a new system of national education.
- (ii.) Later Censuses. In 1841 it was resolved to obtain statistics of agricultural production in Ireland. The attempt was found so successful that it was renewed in greater detail at the census of 1851. The enumeration of the people of Ireland in 1861 was effected for the first time throughout the country (excepting the metropolis) by the officers and men of the Royal Irish Constabulary. In 1871 the enumeration of Ireland was undertaken by the Registrar-General of Ireland.<sup>2</sup> Later censuses have been taken decennially, and are provided for on each occasion by special legislation, as in England, Wales, and Scotland.

### SECTION 2.—BRITISH POSSESSIONS AND DEPENDENCIES.

### A.—INTRODUCTION.

- 1. General.—In most of the British Possessions and Dependencies the census methods of England and Wales are followed more or less closely, the population being enumerated by means of householders' schedules. In India and Ceylon, however, the conditions are greatly different to those of other countries, and consequently it has been found necessary to adopt different methods of enumeration. The enormous population to be enumerated, the general illiteracy of the masses, the varieties of race, and the distinctions of caste and religions, all combine to make the taking of an Indian census a task of considerable difficulty. In Canada the census has been modelled upon that of the United States rather than on that of England and Wales, and in that Dominion the schedules are not left with the householders, but are filled up by the enumerator himself. Another important difference in Canada is that the population de jure is enumerated.
- 2. Census Methods.—As a rule in all British Possessions and Dependencies each country is divided for census purposes into districts placed under a superior officer, often named the "Supervisor" or "Enumerator," who is under the immediate control of the Superintendent of the Census; these districts are again parcelled out into convenient areas for purposes of collection. For each of these latter districts a collector is appointed. The time allowed for the collection of the schedules varies in different countries; in a great number of cases it is found that the collector has to fill in the schedules himself, and the time taken in collection is thus prolonged.

<sup>&</sup>lt;sup>1</sup> See Journal of the Statistical Society of London, Vol. III., p. 91. <sup>2</sup> The Registration Act for Ireland came into force on the 1st January, 1864.

Magistrates, registrars, and civil officers are usually appointed as supervisors or enumerators for their respective districts. The supervisors frequently arrange the division of their districts into collectors' sub-districts, and subject to the approval of the superintendent select their own collectors, and instruct them in the performance of their duties. They arrange for the proper distribution and collection of census forms and books, and audit and examine the collectors' books. The method of payment of the collectors varies considerably; some countries have adopted the system of paying by results, i.e., so much for every person recorded; in other countries a fixed sum is allotted to each official, while in others the collectors are paid by the day. The method of payment by results has been objected to as tending to bring about an exaggeration of the number of persons enumerated. In order to give as much publicity as possible to the fact that a census is about to be taken, advertisements and announcements are usually inserted in the press, and the co-operation of persons of local prominence—such as teachers, and other officials—in each district throughout the country is secured.

### B.—AFRICA.

- 1. Cape of Good Hope.—From the commencement of the colonisation of the Settlement at the Cape of Good Hope in 1652, it was the practice to have annual enumerations of the population, live-stock, and agricultural produce for the purpose of communicating the ascertained results to the Netherlands East India Company. The earliest known of these returns, however, is that for the year 1687, from which date, with a few casual exceptions, they run down to 1785. annual returns were also made under the English administration from 1823 to 1856, when they were discontinued, owing to the untrustworthiness of the results. The first complete census of the Colony in the proper acceptation of that term, was taken in 1865, when the total white population numbered 20,638 persons. The second census was taken in 1875, and the third in It was originally intended to take the fourth census in 1901 in conjunction with the rest of the British Empire; the abnormal conditions created by the military operations in that year, however, compelled the abandonment of the project. Now that it was too late to combine with the rest of the Empire, the chief object to be served was to effect a simultaneous census throughout British South Africa, and it was found that this could not be carried out until 1904. the final arrangements were made for the census of that year an Intercolonial Census Conference was organised at Pretoria to discuss the mode of procedure to be adopted in order to secure uniformity in the more essential points in all the different Territories. The Colonies represented were as follows:—Cape of Good Hope, Natal, Transvaal, Orange River Colony, Bechuanaland Protectorate, and Basutoland. As the Cape Government had, prior to the date of this conference, completed the preliminary arrangements for the census in that Colony, the schedules and forms adopted by the other South African Colonies followed with minor modifications the lines which the experience of the Cape had proved useful and practical. The information required to be collected on the schedule at the census of 1904, according to the plan agreed upon by the Conference of Delegates, embraced the following categories:—(a) Name. (b) Sex. (c) Age. (d) Conjugal Condition. (e) Relation to head of household. (f) Profession or occupation. (g) Sickness or infirmities. (h) Race or nationality. (i) Country where born and length of residence in Colony. (j) Religious denomination. (k) Education. (l) Description of dwelling, and (m) Live stock kept. and (m) Live-stock kept.
- (i.) Census of 1904. The Census Act of 1903 provided for the taking of an account of the number of persons and the number of each kind of live-stock within the Colony, and also for the collection of agricultural, educational, ecclesiastical, industrial, friendly societies' and other statistics by the census supervisors and enumerators. The Colony was divided for census purposes into 108 districts, corresponding to the Fiscal Divisions of the Colony proper, and the Magisterial Districts in the Transkeian Territories. In the former of these the Civil Commissioners and in the latter the Resident Magistrates were appointed ex officio supervisors. The basis finally adopted for fixing the enumerators' sub-districts was to parcel out the country, so that an urban area might be completely traversed by the enumerator in from three to five days, and a rural area in up to nine or ten days. In some instances, however, over a fortnight, and in two cases as much as twenty days, had to be allowed for the collection of the schedules. The total number of the collectors' districts was 2394. Special arrangements were made for the Native census.<sup>2</sup>
- (ii.) Tabulation. In addition to the householder's schedule, special forms (viz., Agricultural, Education, Ecclesiastical, Industrial, Fisheries, and Friendly Societies) were used at the census of 1904. In the work of tabulation two distinct methods were employed. The particulars regarding individual inhabitants, viz., Race, Sex, Birthplace, Religion, Age, Degree of Education, Conjugal Condition, Profession or Occupation, and Sickness or Infirmity, were entered from the schedules on to cards; while, on the other hand, the particulars as to buildings and dwellings and those contained in the special forms were transcribed to the tabulating sheets direct.

<sup>&</sup>lt;sup>1</sup> See "Modes of Census-taking in the British Dominions," R. H. Hooker, M.A. Journal of the Royal Statistical Society, Vol. LVII., p. 327. <sup>2</sup> See Census Report, Cape of Good Hope, 1904, p. i.

- 2. Natal.—The first occasion in which a census was taken in this country was in 1891, but no attempt was made in that year to enumerate the natives. The second census was taken in 1904 in conjunction with the census for the whole of British South Africa. The arrangements, as well as the nature of the particulars collected, at the census of 1904 were very similar to those in the Cape of Good Hope.<sup>1</sup>
- 3. The Orange Free State.— The first census of the Orange Free State was taken in 1880, the second in 1890. The third census was taken in the year 1904, and was synchronous with the censuses of the other South African Colonies.<sup>2</sup> The Magisterial Districts of the Colony (24 in number) were adopted as census districts, to each of which was appointed an enumerator. There were 405 sub-districts, in which 424 collectors and 39 interpreters were employed. The arrangements for the census and the nature of the information collected were similar to those adopted in the Cape of Good Hope, as adopted at the Pretoria Conference. Three householders' schedules were used; one in English, one in Dutch, and the third for natives. Eight special schedules were also used. The cost of the census of 1904 was £6146. For the purposes of tabulation, cards, similar to those used in the Cape of Good Hope, were adopted at the Orange Free State Census of 1904.
- 4. The Transvaal and Swaziland.—The first census of the Transvaal was taken in 1890; no details are available as regards the number of enumerators, and the general carrying out of the work. In 1896 a census of the municipality of Johannesburg, with very full details, was taken. At the census of 1904, taken in conjunction with the censuses of the other South African Colonies, the whole of the Transvaal and Swaziland was divided into 21 supervisors' districts, and 779 collectors' districts. These included 28 districts for the railways, and 6 for the military establishment. The total number of supervisors was 21, collectors 2115 (including 1120 native assistants, and 31 interpreters.<sup>3</sup>)
- 5. Mauritius.—The first census of this island appears to have been taken in 1846. The second census was taken in 1851, and from that year onward a decennial census has been taken, usually on or about the date of the census of the United Kingdom. At the census of 1901 the staff employed comprised 15 superintendents, 98 enumerators, and 239 collectors.
- 6. Seychelles Archipelago.—Though the Seychelles Islands are dependencies of Mauritius, separate censuses have been taken decennially since 1851.
- 7. Protectorates and Minor Possessions.—In most of the British Protectorates and minor Possessions in Africa, censuses, more or less complete, were taken in 1901, under the authority of special Ordinances.

### C.—ASIA.

- 1. India.—In the Indian Empire the social system and the ethnic distribution are the most complicated, the most varied, and the most elaborate that the world presents, and the work of taking a census is thereby rendered exceptionally costly and laborious. Further, the general illiteracy and narrow horizon of an agricultural population not only render the supply of enumerating agency less abundant in India, but also increases the work of enumerating, since it puts out of question the practice of leaving the responsibility of filling in the schedule to the householder. In the work of census-taking, the official administration is used as far as possible; the ordinary administrative business of the country necessitates the presence in each village community of an official who is generally acquainted with every house and family in the place. It is thus possible to largely decentralise the census work. Furthermore, in India there is practically no overlapping of areas.
- (i.) Historical. In certain provinces such as Madras and the Punjâb, the custom of making periodic estimates of the population, founded on more or less accurate data, is of very old standing, but the first systematic attempt to obtain a census for the whole of the Empire of India was made in the years 1871 and 1872, and even then resulted in an incomplete enumeration. Earlier provincial censuses had been taken in the North-West Provinces in 1853 and 1865, in Eurlie Provinces in 1869, in the Punjâb in 1868, in the Hyderabad Assigned Districts in 1867, and in the Central Provinces in 1866. In Madras quinquennial returns had been prepared since 1851. Mention is made of a census having been taken in Bombay in 1716, while unsuccessful attempts are recorded for 1833-4, 1849, 1851 (twice), and 1861, the first really satisfactory census appearing

<sup>&</sup>lt;sup>1</sup> See Census Report, Natal, 1904, p. 22. <sup>2</sup> See Census Report, Orange River Colony, 1904. <sup>3</sup> See Census Report of the Transvaal, 1904, Vols. I and II. <sup>4</sup> See "On Census-taking and its Limitations." Journal of the Royal Statistical Society, J. A. Baines, C.S.I. (now Sir J. Athelstone Baines), Vol. LXIII., p. 44

to have been that of 1864.¹ The enumeration mentioned above as having been made in 1871-2 was, in addition to being incomplete, also non-synchronous. The first synchronous census of all India was that taken in 1881, and this has since been followed by similar enumerations in 1891, 1901, and 1911. The earliest attempts to enumerate the people of any portion of British India were probably those made in 1820.²

- (ii.) Census Methods. The organisation of the census of India is placed in the hands of a Commissioner, under whom Superintendents are appointed in charge of each province, large agency, or more than one small agency. Under the Superintendents are Charge-superintendents, each of whom has charge of a group of "circles." The smallest sub-division for census purposes is a "block" consisting of from 30 to 50 houses in charge of an enumerator. Above the "block" comes the "circle," a compact group of from 10 to 15 blocks, or about 500 houses under a supervisor, who is responsible for the work of all the enumerators in his circle. At the census of 1901 there were in the whole Indian Empire in round numbers 9800 Charge-superintendents, 122,000 Supervisors, and 1,325,000 Enumerators, in all about 1,456,800. A special feature of the Indian Census is the preliminary enumeration, which is made some few weeks prior to the actual census day. At this enumeration all the required particulars are duly entered for every person then resident in each enumerator's district, so that on census day it is only necessary to bring up to date these returns. This is effected by striking out the particulars concerning those who have died or departed in the meantime, and adding others for those who have since arrived or been born.
- (iii.) Method of Tabulation and Cost. At the censuses of 1881 and 1891 the information contained in the schedules was extracted on "abstraction sheets," but at the census of 1901 this method was abandoned in favour of what is known as the slip or card system. The total actual cost of the 1901 census was £137,674, or £146,265 including charges not debited against the census budget in the public accounts.<sup>4</sup>
- (iv.) The Schedules. In India it is specially laid down that the schedules must be filled in by the enumerators, but this does not apply to Europeans or to natives of high rank. The schedule for the census of 1871 contained space for the name, sex, age (under and over 12 only), caste or tribe, religion, occupation, education, and infirmity. The census of 1881, the first synchronous enumeration of all India, added inquiries as to the individual ages, conjugal condition, and language, and at the census of 1891 inquiries as to birthplace and nationality were included. In 1901 the scope of the schedule was the same as in 1891.
- 2. Ceylon.—The census of Ceylon, both in scope and machinery, bears a strong resemblance to that of India, and this resemblance was at the census of 1901 increased by the adoption of the Indian method of preliminary enumeration, and subsequent revision. The Government Agents and the Chairmen of Municipalities and Local Boards are, under the Census Ordinance, ex officio Commissioners of Census for their respective areas. A supervisor is the officer in charge of a "circle," i.e., a group of enumeration "blocks," which contains from 50 to 100 houses, and for each of which an enumerator, in rural districts the village headman, was appointed.
- (i.) Historical Under the native rulers of Ceylon there does not appear to have been anything in the nature of a census, though there is evidence, both historical and physical, to show that the population must have been very much larger than at present. The decline in the population was probably due to the wars and internecine strife which preceded the establishment of the British Dominion. The earliest enumeration of which there is any record is that taken by the Dutch East India Company in 1789. This census, although apparently incomplete, seems to have been more successful than the first attempt in 1814, under British rule. In 1824 the first complete census of the island was commenced; the returns were published in 1827. At this census particulars were obtained as to sex, race, and age, but the age details related only to the numbers above and below the age of puberty. In 1868 the first legislative provision for a census was made, and three years later the first census, in the proper acceptation of that term, was undertaken. Since 1871 a decennial census has been taken.
- (ii.) Census Methods. At the census of 1901 great importance was attached to the "drilling" of the enumerators. Each supervisor was required to put his enumerators through a practical course of training by making them visit a number of houses and fill in schedules for the residents. These trial forms were examined by the supervisor, and mistakes in them were pointed out to, and corrected by, the enumerators. The schedules used were of five kinds:—(a) form to be filled by householders, (b) form to be filled by enumerators, (c) form for the enumeration of the estate population, (d) form for sea-going population, and (e) form for the outdoor population. The form (a) was issued in English only, the rest were issued in each of the three

<sup>&</sup>lt;sup>1</sup> See Census of the Island of Bombay, 1864, p. 1. <sup>2</sup> See Geographical, Statistical, and Historical Description of Hindustan, by W. Hamilton, 1820, and Reports on the State of Education in Bengal, by W. Adam, 1835-38. <sup>3</sup> See Census Report of India for 1901. The supervisors of India were generally subordinate revenue officers, village accountants, and where non-officials were appointed, as in towns, the position was ordinarily looked upon as an honour. Many enumerators were volunteers, and received special certificates where the work was well done. Minor officials were also largely employed for this purpose, and the number of paid enumerators was relatively small. <sup>4</sup> See General Report, Census of India, 1901, Part I., p. xv.

languages, English, Singhalese, and Tamil. In the 1901 schedule a column was added for conjugal condition, and various amendments were made in regard to the particulars asked for concerning nationality, religion, occupation, and English literacy. Particulars of caste are not asked for in Ceylon. For the tabulation of results the "Slip System" was used, on the same lines as the system used in the census of India.<sup>1</sup>

3. Hong-Kong.—The first regular census was taken in Hong-Kong in the year 1881; it was, however, in certain respects, incomplete. Later censuses were taken in 1891, 1897, and 1901, but were not satisfactory in regard to certain of the particulars asked for.<sup>2</sup> The census is taken by police officers, and the "double block" system has been adopted. Under that system each census block is worked by two enumerators, instead of one, the size of the blocks being correspondingly increased. The two enumerators work together, and it is found that a great deal of time is thus saved, as one man can interrogate the members of the house, while the other takes down in writing the information thus obtained. A special feature of the Hong-Kong census is the enumeration of the Chinese living in various kinds of water craft.

### D.—AUSTRALASIA.

- 1. Commonwealth of Australia.—The historical development of census-taking in each State of the Commonwealth is discussed in some detail in the succeeding Section of this Report. (See Chapter IV.). It has, however, been thought desirable, in order to preserve the continuity of this Section, to here give a brief account of the past censuses of Australia.
- (i.) The Creation of the Colonies. Although the shores of Australia had been visited from time to time during the 16th and 17th centuries by various Spanish and Portuguese expeditions, it was not until the 23rd August, 1770, that the history of Australia was brought into political connection with western civilisation. It was on that date that Captain Cook took possession "of the whole eastern coast, from lat. 38° to this place, lat.  $10\frac{1}{2}$ ° S., in right of His Majesty King George the Third." Cook, however, proclaimed British sovereignty only over what are now the eastern parts of New South Wales and Queensland, and formal possession, on behalf of the British Crown, of the whole of the eastern part of the Australian Continent and Tasmania was not taken until the 26th January, 1788. It was on this last date that Captain Phillip's commission, first issued to him on the 12th October, 1786, and amplified on the 2nd April, 1787, was read to the people whom he had brought with him in the "First Fleet."

A full historical account of the period referred to may be found in the "Historical Records of New South Wales," vol. I., parts 1 and 2.

The western part of Australia was annexed on the 2nd May, 1829, when Captain Fremantle, who had been despatched from England in H.M.S. Challenger in charge of a party of intending settlers, hoisted the British flag on the south head of the Swan River, and took possession of "all that part of New Holland which is not included within the territory of New South Wales." Tasmania was constituted a separate colony in 1825, and in 1836 South Australia was created a "province." In 1841 the separation of New Zealand from New South Wales was proclaimed, while Victoria and Queensland were separated in 1851 and 1859 respectively. Though the boundaries of some of the colonies were changed after the year 1859, no further colonies were created subsequent to that date. The following table shews the dates of annexation, first settlement, and creation of the several colonies which now form the Commonwealth, as well as the date of the first regular census taken in each individual colony:—

Australian Colonies.—Dates of Annexation	Settlement,	Creation, and	of First	Censuses.
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Colony.	Date of Annexation.	Date of First Permanent Settlement.	Date of Creation as Separate Colony.	Date of First Census.
New South Wales Tasmania South Australia Victoria Queensland Western Australia	 1770 1788 1788 1770 1770 1829	1788 1803 1836 1834 1824 1829	1786 1825 1834 1851 1859 1829	1828 1841* 1844 1854* 1861* 1848

<sup>\*</sup> Previously included with New South Wales.

A more complete account of the colonisation of Australia may be found in "The Official Year Book of the Commonwealth of Australia," No. IV., pp. 12 to 27.

<sup>&</sup>lt;sup>1</sup> See The Census of Ceylon, 1901, Vol. I., p. 36, <sup>2</sup> See Census Report of Hong-Kong, 1901, p. 1.

- (ii.) Early Musters. Though regular censuses were not instituted in the several colonies until the years specified in the preceding table, population returns in one form or another have existed from a very early period in the history of Australia. The earliest enumerations were known as "musters," and although the actual results of very few of them have been preserved, it is probable that during the early days of colonisation they were of frequent occurrence. The first official "muster" was taken in 1788, soon after the new settlement at Sydney Cove was formed, and in 1803 the first "muster" of convicts in Van Diemen's Land was conducted. In 1813 Liverpool was included among the "mustering" stations; and in 1815 vital statistics were given for the towns of Castlereagh and Richmond, thus shewing the spread of settlement along the Nepean River. In the reports of subsequent "musters" the growth of the infant colony may be clearly traced. Thus in 1822 appear such names as Evan District in County Cumberland, Wilberforce on the further bank of the Hawkesbury, Illawarra, and Argyleshire. The statement of 1823 gives the new "mustering" stations of Bringelly, Campbelltown, and Cawdor; in 1824 Moreton Bay, consequent upon Oxley's discovery of the Brisbane River, and Melville Island, indicating the settlement of a military post on the northern coast of Australia, first appear. The growth of the metropolitan district is also shewn in the returns; thus in 1825 the Field of Mars is shewn as a distinct area, while such additional districts or parishes as Sackville Reach, Pitt Town, Kelso, and Christ's Church also appear.
- (iii.) The Development of the Census. The first regular Australasian Census was taken in New South Wales in November, 1828, and included the population at Moreton Bay (now Queensland), and Van Diemen's Land (now Tasmania). Particulars were asked as to the names, ages, and civil conditions of the inhabitants. The next census was taken in 1833, and was followed by another in 1836, when arrangements were made for the enumeration of the population of the newly-established settlement at Port Phillip (Victoria). These two censuses were similar in their scope and provisions to that of 1828. In 1841 separate censuses were taken in New South Wales (including the Moreton Bay and Port Phillip districts) and Tasmania. New Zealand. which was first settled in 1839, was expressly exempted from the provisions of the New South Wales Census Act 1841; but it was not until May, 1841, that the islands composing the group were proclaimed an independent colony. Up to that date they continued a dependency of New South Wales. The first regular census was taken in South Australia in 1844, and in Western Australia in 1848. The dates of succeeding censuses are shewn in the tabular statement given in Chapter IV hereinafter. All the early censuses of the Australian colonies were based in their main features upon the methods adopted in England, and do not at present call for further notice.
- (iv.) Recent Censuses and Census Conferences. While the fact that the census methods adopted in the several Australian colonies were based on a common prototype had the beneficent result of conducing towards general uniformity, it also gave rise to the reproduction of certain defects in English methods and to want of conformity to local circumstances. In course of time it appeared evident that the methods of inquiry and tabulation were in certain respects ill-adapted to Australasian conditions, and in 1890 a Conference of Statisticians was held at Hobart for the purpose of preparing a scheme by means of which the census information could be collected and tabulated throughout Australasia in a uniform and effective manner. Though neither Queensland nor Western Australia was represented at this Conference, the decisions of the Conference were followed in the collection and compilation of the censuses in these colonies. This Conference resulted in considerable improvement in the degree of uniformity attained in the censuses of 1891 and in the increased fertility of the inquiries.

In 1900 another Conference of Australasian Statisticians was held in Sydney. The colonies represented were New South Wales, Victoria, Queensland, South Australia, Western Australia, Tasmania, and New Zealand. The object of the Conference was to agree to such measures as would lead to uniformity in regard to—(a) the date of the census; (b) the subjects of inquiry; and (c) the methods of compilation and tabulation. Although practical uniformity was attained in some respects in the census methods of the Australasian Colonies in 1901, yet the facts that the modes of presentation of the reports and tabular matter were not uniform, that the results of all the inquiries were not completely tabulated for all the States, and that differences arose as to interpretation of terms, rendered it difficult and in some cases impossible to obtain totals for the whole Commonwealth.

- 2. New Zealand.—Reference has already been made to the facts that New Zealand, which was first permanently settled in 1839, was separated from New South Wales in 1841, and was expressly exempted from the provisions of the New South Wales Census Act of that year. In 1852 representative government was granted in New Zealand, with a Legislative Council for the whole Colony, and six provincial district Councils, presided over by an elective superintendent. The provincial governments were abolished in 1876.
- (i.) The First Census, 1851. So far as can be ascertained, the first general census of New Zealand was taken in 1851 under authority of an Ordinance (No. 8) of the Legislative Council. The different settlements constituted Census Districts. Resident Magistrates promulgated all information for filling in schedules, etc., and collectors were appointed by the Governor-in-Chief at a rate not exceeding ten shillings per day. No information is available as to scope of inquiry, methods of compilation, or cost of census.

In 1853 the Constitution Act came into operation, and an effort was then made to present the General Statistics of the entire Colony in one comprehensive and authorised compilation. But after considerable delay and some embarrassing difficulties it was found that the work was incomplete in several particulars. The census abstracts had their own peculiar difficulties arising from such circumstances as the census having been taken at different times in the several Provinces, and even in the same Province in different months, on successive occasions. There was also want of uniformity in the schedules, not merely as to absence of details but also as to important branches of inquiry. Tables which could be completed for parts of the Colony, could not be completed even approximately for the whole.

- (ii.) Census of 1858. The census taken in 1858 under authority of the "Census Act 1858," was the first to be taken throughout the whole of New Zealand on a uniform system. The machinery for the collection of the census information in each Province was virtually organised by its own Provincial Government. The divisions of Provinces under the Constitution Act were adopted as census districts. The number of districts was seven. The appointments of enumerators for the several Provinces were all made by the Governor, on the recommendation of the several superintendents. Sub-enumerators were appointed by enumerators. Masters or keepers of asylums, gaols, etc., were appointed sub-enumerators.
  - (a) Scope of Inquiry. The following were the subjects of inquiry in 1858:—
    (1) Domestic and social condition. (2) Number and descriptions of houses and buildings. (3) Names and surnames of the people. (4) Relation to heads of the households. (5) Their condition as married, single, etc. (6) Age and sex, profession or occupation. (7) Extraction and place of birth. (8) Religious denominations. (9) The date of entry into Colony: whether British subjects or aliens. (10) The number of persons able to read or write. (11) The number of acres under crops, sown grasses, etc., and the number of acres fenced. Information was also requested concerning churches, chapels, etc., their situation, the number of persons each would contain, and the number generally attending, and as to hospitals, asylums, dispensaries, etc., savings banks, friendly and benevolent societies, mechanics' institutes, and other literary or scientific institutions, manufactories, mills, works, mines and quarries. The returns shewing this information were, however, incomplete, and of little value.
  - (b) Compilation. The returns were compiled by enumerators from the schedules, and transmitted to the Registrar-General.
- (iii.) Census of 1861. The census of 1861 was taken under authority of the "Census Act 1858," and the "Census Act Amendment 1860." The person responsible for the carrying out of the census was the Registrar-General. The machinery for collection of the census information in each Province was virtually the same as at the preceding census. Arrangements were made to obtain the required information, not only as formerly for each Province of the Colony, but also for each electoral district. Electoral districts as defined by the Representation Act 1860 were constituted census districts, of which there were 43. The scope of inquiry was similar to that of 1858.
- (iv.) Census of 1864. The census of 1864 was taken on the same lines as that of 1861, the number of census districts being 45. The military settlers and defence forces in the North Island were a new addition to the population, and were included in the numbers for the Provinces, but not in those for the Electoral Districts. Officers of Regiments were appointed enumerators.
- (v.) Censuses of 1867, 1871, 1874, and 1878. The census of 1867 was taken under authority of the Census Act 1867. There were 64 census districts. Special inquiries concerning uninhabited houses and houses building were introduced this year.

Schedules III. and IV. of the Census Act, 1858, were repealed by the Census Act of 1867, and the following subjects of inquiry were substituted:—Extent of holding, freehold or leasehold. Extent of land fenced. Extent and description of fencing. Extent of land broken upbut not under crop. Extent of land in crop in detail. Horses, cattle, sheep, etc. Annual production of butter and cheese. All kinds of machinery and description of manufactories.

The methods adopted at the censuses of 1871 and 1874 were substantially the same as in previous years. The census of 1874 was the last of the triennial censuses which commenced in 1858. In 1878 it was thought that the Provinces were too large to admit of proper supervision and control as enumerators' districts, and the colony was accordingly subdivided into 25 districts. As the Census Act 1877 did not apply to Maoris, the census taken of them by the Native Department was quite distinct in character from that taken of the rest of the population. Since this Act was passed statistics of manufacturing industries have also been collected at each of the New Zealand censuses.

(vi.) Censuses of 1881, 1886, 1891, and 1896. The census of 1881 was the first of the quinquennial censuses which have been taken in New Zealand since that year; the system adopted in 1881 was similar to that at the previous census. The New Zealand householder's schedule contained very extensive inquiries, as, in addition to the particulars of persons

information had to be given thereon as to lands occupied and unoccupied, the nature of tenure, the amount of fencing, the numbers and description of live-stock and poultry, the annual produce of butter and cheese, and the number of threshing and reaping machines, steam ploughs, and harrows.

In 1886 a more elaborate census was taken of the Maoris than at any previous census, the tabulation being effected through the "Native Officers" according to numbers, sex, ages, principal tribes, and counties.

At the censuses of 1891 and 1896 the inquiries made embraced the same subjects as before, with the exception that in the latter year no information was required as to land cultivation and live-stock, for the reason that these matters were dealt with annually under the provisions of the Agricultural and Pastoral Statistics Act 1895. In 1896 the inquiry as to the domestic and social condition of the people covered the following matters:—(a) Number and description of dwellings. (b) Names. (c) Relation to head of household. (d) Conjugal condition. (e) Sex and age. (f) Occupation. (g) Nationality and birthplace. (h) Religion. (i) Naturalisation. (j) Sickness, accident, and infirmity, and (k) Education. Manufacturing statistics were also obtained on special schedules, and returns were collected under the fourth schedule of the Act of 1877, as to the number of churches, their accommodation and the attendance thereat, and as to land and building societies, mechanics' institutes, and other literary or scientific institutes. In 1896 the card system of compilation was adopted for the first time.

(vii.) Censuses of 1901 and 1906. As a result of the deliberations of the Australasian Statistical Conference held in February and March, 1900, arrangements were made for a uniform householder's schedule, and for general agreement in methods of compilation, so as to render the results for the several Colonies more fully comparable. As regards New Zealand, the most important alteration in the schedule was by way of introducing an inquiry as to length of residence of all persons not born in the colony. In 1906 the schedule was practically identical with that of 1901. In 1906 the Maori population was not enumerated by the officers who took the general census. It had been found impossible to take an account of the Maoris for one night, and the required particulars were collected during the month of April by "native agents" and magistrates of "native districts." A third count was made on special lines, viz., that of the population of the Cook and other South Sea islands, which now form part of New Zealand.

(viii.) Population and Cost of Censuses. The following table gives particulars of the population enumerated and the cost (exclusive of printing) of each census from 1851 to 1911, inclusive:—

New	Zealand	Censuses,	<b>Population</b>	Enumerated	and	Cost.	1851	to	1911.	
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Co	Popula	ation.	Cost	of Collection	n.	Cost of		Cost
Census.	European.	Maori.	European Census.	Maori Census.	Total.	Compila- tion, etc.	Total Cost.	per Head
	No.	No.	£	£	£	£	£	d,
1851	26,707	1	1		1	1	~ <sub>1</sub>	1
1858	61,224	1	1	• •	1	1	2,018	8
1861	106,315	1	1		1	1	3,296	$7\frac{1}{2}$
1864	184,131	1	1		1	1	$\begin{array}{c} 3,290 \\ 6,245 \end{array}$	/ ½
1867	220,123	1	1		1	1 1	6,787	81
1871	256,393	1	1		1	1	9,649	$7^{rac{ ilde{1}}{2}}$
1874²	299,514	45,470	1	i	1	1	8,741	
1878	414,412	43,595	1	106	1	1		$6\frac{1}{4}$
1881	489,933	44,097	1	278	1	1 1	10,084	24
1886	578,482	41,969	10,119	573	10,692	2.050	12,2503	.0 <del>1</del>
1891	626,658	41,993	9,734	789	10,523	3,959	14,651	512355555555555555555555555555555555555
1896	703,360	39,854	10,216	819		5,608	16,131	57
1901	772,719	43,143	12,202	962	$11,035 \\ 13,164$	5,317	16,352	5 <del>1</del>
1906	888.578	47,731	14,310	1,378		6,237	19,401	54
1911	1,008,468	49,844	18,058		15,688	8,229	23,917	6 <u>1</u>
	1,000,400	±0,044	10,008	1,419	19,477	11,123	30,600	7

Not available.

### E.—BRITISH NORTH AMERICA.

1. Canada.—The Department of Agriculture, which has charge of the Canadian Census operations, has shewn itself far more ambitious than the Governments of other parts of the British Empire, and has modelled the census upon that of the United States. An elaborate investigation is made into the components of the general wealth and economic condition of the country. In 1901 the enumeration proper was conducted with the help of 17 chief or supervising officers for the Provinces or Territories, of 351 directing and revising commissioners and assistant commissioners for the census districts, and of 8800 enumerators for the polling divisions.

<sup>&</sup>lt;sup>2</sup> First Maori Census.

<sup>&</sup>lt;sup>3</sup> Approximate.

- (i.) Historical. The first Canadian Census, and probably the first regular census of modern times, was that of the province of Quebec, then known as La Nouvelle France. This census was taken in the year 1665. From that year onward until 1754 enumerations were of frequent occurrence, no fewer than fifteen regular censuses (in addition to numerous "statements of population") being taken during that period. Censuses of "Canada" were taken in 1765 and 1784, while in "Upper Canada"—or what is now practically the province of Ontario—the census was annual from 1824 till 1842. Censuses in the different districts continued to be frequent until 1861, after which date no official enumeration took place until 1869-71. The census of 1871, the first after the passing of the British North American Act in 1867, included Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island, other parts of the Colony having enumerated their populations just previously. Since 1871 the census of Canada has been decennial, but an intermediate census was taken in the North West Territories in 1885, and in Manitoba in 1886.
- (ii.) Census Methods. There are two important points to be noticed in connection with the Canadian Census, viz. (a) that the de jure population is enumerated (see p. 11 hereinbefore), and (b) that the schedules are filled up by the enumerators and not by the householders. In 1901 there were 206 census districts, and 3204 sub-districts. The enumeration in the field was required to be completed within 30 days, including time for the revision of all schedules by the Commissioners before transmission to the Census Office.
- (iii.) Tabulation and Cost. In tabulating the returns, the Hollerith electrical tabulating machine, introduced in the United States, was employed at the 1891 and subsequent Canadian Censuses. The general object and working of this machine is described elsewhere (see pp. 15 and 16 hereinbefore). Particulars as to the cost of the census of 1901 are not available. The cost of the census of 1891 (when the population enumerated was 4,833,239) was £108,000, of which £85,000 were for the enumeration (local expenses), £20,000 for compilation and tabulation (office expenses), and the remainder represented printing and incidental expenses.

As regards the scope of the inquiry, the first census (1665) enumerated the population de jure by families, age, sex, conjugal condition, and professions and trades (not occupations of the whole people). The scope of the inquiry has varied in succeeding censuses; the "professions and trades" were soon dropped, but agricultural statistics and particulars of buildings were, on the other hand, included. The scope of the censuses taken during the 18th century was not generally so wide as in the preceding censuses. During the 19th century the inquiries differed materially in their scope. The ages at first consisted of two groups only—persons under and over 16—but the number of groups was gradually increased. Birthplaces appear for the first time in 1817 (in a census of Nova Scotia), occupations reappear in 1827, in which year also the earliest reliable statistics of religion, births, marriages, deaths, education, and industries are given; infirmities were first recorded in 1842.

During more recent censuses, owing to the large amount of information which is sought to be obtained, a number of different schedules, each comprising a considerable number of questions and printed in both English and French, are used. The census of 1891 was taken with 9 schedules, comprising in all 216 questions, and the census of 1901 with 11 schedules, comprising 561 questions, as shewn in the following tabular statement:—

No. of Schedule.	Subject.	No. of Inquiries.	No. of Schedule.	Subject.	No. of Inquiries.
I. II.	Living persons Buildings, lands, churches,	34	VI.	Live-stock and animal pro-	26
	and schools	<b>3</b> 5	VII.	Agricultural values	25
III.	Deaths	15	VIII.	Manufacturers	67
IV.	Farmlands, fruits, and plant-		IX.	Forest products and furs	51
	ations	37	X.	Fisheries	130
v.	Field products	37	XI.	Mines	104

Canada—Schedules and Inquiries at 1901 Census.1

Besides the foregoing, there were used at the 1901 census of Canada special forms for obtaining records of (a) persons temporarily absent, (b) persons such as boarders and lodgers, not present when the enumerator called and of whom particulars could not be given by the head of the household, (c) cheese and butter products, and (d) manufactures of clay products. The schedules contained inquiries to ascertain for every trade, occupation, and profession the time each person was employed and the amount of his earnings, and for all children of school age the time at school in the year.

2. Newfoundland and Labrador.—In this Colony the first complete census appears to have been taken in 1857. Later censuses were taken in 1869, 1874, 1884, and 1891, and since the last of these dates the census has been taken decennially.

<sup>&</sup>lt;sup>1</sup> See Census Report, Canada, 1901, Vol. I., p. vii.

<sup>&</sup>lt;sup>1</sup> See Modes of Census-taking. Hooker, J.R.S.S., Vol. LVII., p. 337.

In many respects the census of Newfoundland resembles that of Canada, and deals not only with persons living, but also with births, marriages, and deaths (for the year preceding that in which the census is taken), fisheries, buildings, ships and boats, primary production, mines and minerals, and mills and factories.

The census of Labrador is not simultaneous. A large number of the population can be found at their homes only during the winter season—a time when it is impossible to take the census owing to difficulties of communication. In the summer these people are engaged in the fisheries off the coast—but the enumerator counts them as resident in their place of abode during the winter. Special provision has to be made to avoid duplication of entry, and in most cases the schedules are retained until December, when most of the people have returned home, and the sheets can be checked.¹ The number enumerated, therefore, appears to be a compromise between the de jure and de facto population.

#### F.—WEST INDIES AND BRITISH SOUTH AMERICA.

- 1. **General.**—In the West Indies (with which may be grouped British Guiana, British Honduras, and the Bermudas) the particulars collected and the arrangement made for the censuses are similar to those in other British Possessions. The principal feature of note is the inquiry which is usually made as to colour and native population.
- 2. Bahama Islands.—In these islands there has been a decennial census since the year 1891. Particulars are collected with regard to sex, age, conjugal condition, profession or occupation, nationality, infirmities, and education, and a special inquiry is made as to the number of people vaccinated.<sup>2</sup>
- 3. British Honduras.—In this Colony one quarter of the schedules were printed in Spanish at both the 1891 and 1901 censuses. As regards the degree of education, the return is more clearly defined than usual with reference to writing, persons being required to state whether they could write their names.<sup>3</sup>
- 4. Other British Possessions.—In other British possessions (including Bermudas, Barbados, Jamaica, the Leeward Islands, Trinidad, and British Guiana) censuses were taken in 1891 and 1901. The particulars collected and the arrangements made were much the same as elsewhere, but in the smaller colonies the returns comprise only a few sheets. The principal points calling for remark are the inquiries as to colour and Indian population.<sup>4</sup>

### SECTION 3.—FOREIGN COUNTRIES.

## A.—EUROPE.

1. General.—The censuses of most European countries are now carried out through the agency of the local authorities, the chief executive officers of which are in many countries also officers of the Central Government.<sup>5</sup> The work of the census is ordinarily under the control of the Minister of the Interior, or some other responsible Minister, by whom explicit instructions are issued to the Local Government officers as to their duties and functions, and as to the methods of enumeration to be adopted. By these means the work of census-taking is greatly facilitated, and in many countries the cost of the census is considerably reduced by reason of the fact that the work is carried out by the Local Government authorities without extra pay or for a small extra allowance. The work of tabulation is also in many cases carried out primarily by the local authorities for their respective districts, and the results forwarded to the central office, where the final tables are compiled.

In France, for example, the direction of the census is under the control of the Minister of the Interior, by whom instructions and notes are issued to the Prefects of the various Departments. The prefect has charge of the census in his Department, which is divided into arrondissements, generally under the control of sub-prefects; one or more arrondissements form a commune or municipality, of which the mayor is the representative, as well as being the agent of the Central Government. Similarly in Prussia the Local Government districts are Provinces, Government Districts (Regierungsbezirke), urban circles (Stadtkreise), and rural circles (Landkreise). Similarly in Switzerland there are cantons, districts (Amtsbezirke), and communes, and in Belgium, provinces, communes and arrondissements.

<sup>&</sup>lt;sup>1</sup> See Census Report, Newfoundland, 1901, p. v. <sup>2</sup> See Census Report of Bahama Islands, 1901, p. 7. <sup>3</sup> See Census Report, British Honduras, 1901, p. 11. <sup>4</sup> See Hooker, "Modes of Census-taking in the British Dominions." J.R.S.S., Vol LVII., pp. 341-2. <sup>5</sup> Some description of the systems of local government in force on the Continent of Europe is given in the Official Year Book of the Commonwealth of Australia, No. 2 (1909), p. 978-80.

The individual "schedule" (see p. 13) has been very generally adopted on the Continent of Europe, the work of tabulation being carried out (without transcription) on the "card system" (see p. 15) by the use of these schedules. In many countries both the population de facto and the population de jure are enumerated.

- 2. **Spain.**—A census is said to have been taken in the Kingdom of Aragon as early as the 14th century. In the following century an enumeration of the people of Castille was ordered by the Crown, and a report of this enumeration printed at Madrid. In the eighteenth century two general censuses of Spain were taken and reports thereof were published in 1787 and 1801 respectively. In later years census-taking in Spain has proceeded irregularly, the next enumeration of which there is any record being made in the year 1857. This was followed by censuses in 1860, 1877, 1887, 1897, and 1900.
- 3. **Germany.**—With the exception of the enumerations said to have taken place in Spain in the 14th and 15th centuries, just referred to, the earliest development of the modern census in Europe appears to have taken place in districts which are now part of the German Empire. These early enumerations have already been referred to. (See Chapter I., Section 4, p. 5.)

In Prussia a central bureau was established in 1805, through which population reports were obtained; a yearly census was taken from 1815 until 1822, and after that year triennial censuses were taken until the year 1867. In 1843 several of the States agreed to take a synchronous census on a uniform basis, and in 1852 other States entered into the agreement. The first census for the whole of the German Empire was taken in the year of its foundation, viz., in 1871,² and the second in 1875. Since that date the German Census has been taken quinquennially in the fifth and tenth year of each decade. An occupation census of Germany was taken in 1907.

- 4. **Sweden.**—The "Table Commission," which was charged with the duty of collecting through the clergy periodical returns of population and annual returns of births, marriages, and deaths, was founded in 1748, and the superintendence of the enumerations of the people was entrusted to that body. A census was taken in 1749, and was followed by seven triennial censuses during the period from 1757 to 1775, and after that by a quinquennial census until 1860, and by a decennial census from the last-mentioned year up to the present time.
- 5. France.—In France official estimates of the population were made in 1700, and again in 1784, the latter being founded on the mean annual number of births. A "census of hearths" was taken by the Duc d'Argenson in 1753. A regular census was ordered in 1791, but it was not accomplished until ten years later, the delay being due to the Revolution. The second census was taken in 1806, the third in 1821, and the fourth in 1831. An estimate was prepared for the year 1816, based on the figures of the 1806 census, and the records of births and deaths which had occurred in the interval. From the year 1831 onwards a census has been taken quinquennially with the single exception that, owing to the Franco-Prussian war, the census which should have been taken in 1871 was deferred until 1872.
- 6. **Belgium.**—Special provision was made for the collection of statistics in Belgium in 1831, and in 1856 a law was passed providing that a general census of the people should be taken every ten years, and indicating the method of enumeration to be adopted. In 1880 a further law was passed providing that the census should be taken decennially in the tenth year of each decade. An enumeration is made both of "la population de fait" and "la population de droit." The "bulletin de menage" forms the basis of the schedule, which is carried out by the Local Government authorities with the aid of "agents recenseurs" remunerated by the Government.<sup>5</sup>
- 7. Norway.—The Norwegian census was instituted as early as 1769. The second census was taken in 1801, the third in 1815, the fourth in 1825, and the fifth in 1835. It is now taken decennially in the tenth year of each decade.
- 8. Switzerland.—The original constitution of the Swiss Federation required a census once every twenty years, but in 1860 a Federal law was passed prescribing a decennial enumeration. This law, however, does not appear to have been strictly complied with, as the census of 1880 was followed by one in 1888, and this latter by the census of 1900.
- 9. Italy.—One of the most complete censuses of any which had up to that time been executed in Europe was that taken in Sardinia in 1838. A Bureau of Statistics was created in 1860, and the first regular census of Italy was taken in 1861, succeeded by further censuses in 1871 and 1881. A gap of twenty years then occurred, the next census being that of 1901.

<sup>&#</sup>x27;See Review of the Statistics of Spain to 1857. F. Hendriks, Journal of the Royal Statistical Society, Vol. XXIII., p. 148. <sup>2</sup> See Statistik des Deutschen Reichs, Band 150. Die Volkszählung, 1900, Erster Teil, pp. 1-2. <sup>3</sup> See On the Vital Statistics of Sweden, from 1749 to 1855, by F. Hendriks. Journal of the Royal Statistical Society, Vol. XXV., p. 111. <sup>4</sup> See Studies in Statistics, Longstaff, p. 193. <sup>5</sup> See Statistique de la Belgique, Recensement General, 1900, p. iv.

- 10. Austria.—Prior to 1851 no census of Austria had been taken, the only population returns obtainable being those connected with military conscription. The first complete census was taken in 1869, and was followed by the census of 1880. Since the latter date the census has been taken decennially in the last year of the decade.
- 11. Greece —The first census of modern Greece is stated to have taken place in 1836, and to have been succeeded by annual enumerations until the year 1845. From that year onwards censuses appear to have been taken at irregular intervals, the most recent being those of 1879, 1889, 1896, and 1907.
- 12. Russia.—Partial censuses of the population for purposes of revenue and military conscription are said to have been taken in Russia as early as the year 1700, and at irregular intervals throughout the eighteenth century, but it appears that these enumerations did not include females. More complete revisions were taken in 1812, 1815, 1834, 1850, and thenceforward at somewhat irregular intervals. The first and only complete and regular census of the Russian Empire was taken in 1897.
- 13. Netherlands.—The first census of the Netherlands was taken in 1829, and has been succeeded by censuses taken decennially.

### B.—AMERICA.

- 1. The United States.—Provision for a decennial census in the United States of America was contained in the Constitution of 1787, the first enumeration to be made "within three years after the first meeting of the Congress of the United States." This provision was rendered necessary for the purpose of equitably allocating the representation of the States in, and their financial obligations to, the Federal Government. The first census was taken in the year 1790 under the superintendence of the marshals of the several judicial districts, the returns all being referred to the 1st August of that year, though the work of canvassing was extended over a considerable period. The first census comprised six questions as to population, distinguishing free persons, their sex and colour, and the number of free males 16 years of age and over. Subsequent censuses have been taken decennially, the thirteenth being taken for the 13th April, 1910. Incidentally it may be here mentioned that Elkanah Watson predicted in 1815 the population of the United States very accurately up to 1860. From that time on the prediction is increasingly in error.<sup>2</sup>
- (i.) Scope of the Census. Beginning with six simple questions relating to population, the amount and scope of the information secured at the census of the United States has increased to such an extent that it has become too extensive to be tabulated by hand within a reasonable period. The peculiar features by which this census has come to differ from that of other countries are probably attributable to the fact that no special power is granted under the Constitution to the Federal Government to undertake general statistical inquiries. The provision for a decennial census has, therefore, been taken advantage of to secure much statistical information which ordinarily is not connected with a census. The first such enlargement of the scope of the census was in 1810, when particulars of manufacturing establishments In 1840 inquiries respecting schools were incorporated. It was at the seventh were collected. census in 1850, however, that the main enlargement was effected. By an Act passed in that year, the census was extended to cover the name of every free person, the number of dwellings and families, the value of real estate owned, birthplace, number of persons married within the year, number of paupers and convicts, mortality, and social statistics; the inquiries concerning population, agriculture, and manufactures were systematised, and a separate schedule was used for slaves. The census of 1850 marked the beginning of scientific census inquiry in the United States and in consequence the census of that year is known as the first modern census of that country. By an Act of 1902 the Census Office was made a permanent bureau of the Government. At the thirteenth census of the United States, taken on the 13th April, 1910, as at preceding censuses, a number of different schedules was used. The advance schedule of population was filled in prior to the date of the census by the head of the family; the schedule proper, filled in by the enumerator, contained inquiries as to name, relationship to head of family, sex, colour or race, age, conjugal condition, number of years married, number of children born and living (referred to mothers only), birthplace (of each person and of his father and mother), date of immigration, naturalisation, language, occupation, whether out of work at date of census and number of weeks out of work during 1909, education, ownership of home, whether a survivor of the Union or Confederate, Army or Navy, and whether blind, deaf, or dumb. A special individual slip was provided for persons absent during census day. Special schedules were used for hotels, for families absent from their usual places of abode on census day, for agriculture (32 questions), for slaughterhouses, for Indians on reservations, and for domestic animals not on farms or ranges. The census of mines, quarries, petroleum, and natural gas comprised 38 different schedules, while 56 schedules were used for the census of manufactures.

¹ See American Census-Taking, The Hon. W. R. Merriman, Director of Census, Department of Commerce and Labor, 1903, p. 7.
² See Encyclopaedia Britannica, 9th Ed., Vol. XXIII., p. 818.

- (ii.) Method of Enumeration. The method of enumeration in the United States has invariably been that of entry of particulars by the canvassing enumerator after inquiries made either viva voce or by post, or by advance schedules. In 1850 the supervision of the census was committed to the newly created Department of the Interior. In 1880 a radical change was effected; up to this time the work of enumeration had been entrusted to the marshals, but by an Act passed in that year a new body of census officials, known as supervisors, was created. The supervisor's district was divided into enumeration districts, each of which was assigned to an enumerator or collector.
- (iii.) Tabulation. At the first four censuses of the United States very little tabulation was required to be carried out, the returns of the marshals being transmitted direct to the printer. By 1870, however, the population of the country and the scope of the inquiry had extended to such a degree that it was found necessary to obtain mechanical assistance in the work of tabulation. At that time it became evident that a point would be reached before many decades had passed when complete tabulation within the census period would be actually At the census of 1870 and 1880, therefore, the impossible without mechanical assistance. Seaton tabulating machine was used. This machine was composed of parallel rollers, by which the blank tabulating columns were brought into close proximity so as to facilitate the work of the In 1890 the Hollerith electrical tabulating machine was adopted, and this machine was used also at the succeeding census of the United States, viz., in 1900. A brief description of the Hollerith machine has already been given (see p. 15 ante). At the census of 1900 also, automatic electric sorters were first adopted, and their use was greatly extended in connection with the census of 1910. A brief description of these automatic sorters has also been given above (see p. 16 ante). For the 1910 census a new mechanism was employed.

The total number of persons employed in the twelfth (1900) census of the United States was 59,373; the total number of schedules received was 7,296,925, and of cards punched was 215,893,174. The population enumerated was 76,085,794, and the total cost £2,439,000, or 7.69 pence per capita.

# CHAPTER IV.

# CENSUS - TAKING IN AUSTRALIA.

## SECTION 1.—INTRODUCTION.

- 1. **General.**—The historical development of the census in Australia has been briefly referred to hereinbefore (see Chapter III., Section 2 D). It is proposed to deal with this matter more fully in the present Chapter.
- 2. Dates of Censuses in Australia.—The first regular census in Australia was that of New South Wales, in November, 1828. The dates on which censuses have been taken in the several States, and the populations enumerated thereat are shewn in the following tabular statement:—

## Australian Censuses.

Census		Population	Enumerated (	exclusive of F	ull-blooded A	boriginals).	
Year.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	Common wealth. (Total)
1000	(Nov.)						
1828	36,598 (2nd Sept.)	• •	• •	• •	••	· • •	• •
1833	60,794 (2nd Sept.)	••	• •	• •			••
1836	77,096			••		/0F:1 G	••,
1841	(2nd March) 130,856			••		$(27 { m th \ Sept.})^{1} \ 50,216$	
1044		:		(26th Feb.)			
1844	(2nd March)	••	••	17,366 (26th Feb.)	• •	••	• •
1846	189,609	••	••	22,390		• •	
1848		· . ••			(10th Oct.) 4,622	(1st Jan.) 70,164	
1071	(lst Mar.) <sup>2</sup>		!	(1st Jan.)		(lst March)	
1851	268,344	(26th April)1	• •	63,700	(904)	70,130	
1854		234,298			(30th Sept.) 11,743		
1855				(31st March) 85,821			
1856	(1st March) 269,722						!
1857		(29th Mar.) 408,998				(31st Mar.) 81.492	
		,	į	,,,	(31st Dec.)	. 01,102	• •
1859					14,837		
1861	(7th April) 350,860	(7th April) 538,628	(7th April) <sup>1</sup> 30,059	(7th April) 126,830		(7th April) 89,977	
1864			(lst Jan.)	123,500			
1002	••		61,467	(26th Mar.)	• •	••	••
1866	••	••	(2nd Mar.)	163,452	• •		• •
1868			99,901	• •			
1870	ļ.,.	••	i : ••		(31st Mar.) 24,785	(7th Feb.) 99,328	
1871	(2nd April) 502,998	(2nd April) 730,198	(1st Sept.) 120,104	(2nd April) 185,626			
1050			(lst May)	(26th Mar.)			
1876 1881°	749,825	861,566	173,283 213,525	213,271 279,865	29,708	115,705	2,250,19
1000			(lst May)		,	1	. , , , , ,
$\begin{array}{c} 1886 \\ 1891 \end{array}$	1,123,954	1 120 040	322,853		10.753		0.15.00
1891*	1,123,954	1,139,840 1,201,070	393,718 498,129	320,431 363,157	49,782 184,124	146,667 172,475	3,174,39
	1,646,734)	, ,		( 408,558)	1	-	3,773,80
19116	1,714	1,315,551	605,813	83,310	282,114	191,211	<sup>7</sup> 4,455,00

<sup>&</sup>lt;sup>1</sup> Previously included with New South Wales.

<sup>2</sup> Including Port Phillip District, which afterwards became the Colony of Victoria.

<sup>3</sup> 3rd April.

<sup>4</sup> 5th April.

<sup>5</sup> 31st March.

<sup>6</sup> 3rd April.

<sup>7</sup> Federal Territory previously included with New South Wales.

<sup>8</sup> Northern Territory previously included with South Australia.

- 3. Uniformity in Census Methods.— The desirability of obtaining uniformity throughout the British Empire in census matters has long been recognised by those responsible for carrying out the censuses of the several Australian Colonies, and various efforts have from time to time been made in that direction. The degree of uniformity which it is possible to attain is, however, limited by various extraneous considerations. The conditions of progress in the Commonwealth are not, for instance, identical with those in the United Kingdom, and an absolutely uniform census of the British Empire, embracing such diverse populations, conditions, and characteristics as those of South Africa, India, Canada, and Australia, could only be possible at the expense of completeness in many parts of the Empire.
- (i.) The Question of a Simultaneous Census for the British Empire. Again, as to the desirability of attempting to carry out simultaneously a census for the whole Empire, it is of course a matter of impossibility to select any special date which would not at some time, or in some place, be unsuitable or inconvenient. Though the date now ordinarily fixed for the taking of the census, viz., about the first Sunday in the month of April, is probably the most favourable in the British Isles owing to climatic and other conditions, serious difficulties have occurred in taking the census at that time in Australia. For example, at the census of 1891, and again in 1911, the collectors in Queensland were greatly inconvenienced in carrying out their duties by the heavy rains which occurred and the boggy nature of the country, while at the same time the collectors in Western Australia had in some cases to contend against the effects of a drought and scarcity of feed for their horses. Again, the census of India was taken on the night of and scarcity of feed for their horses. Again, the census of India was taken on the night of 1st March, 1901, instead of on the 31st March, the date originally chosen by the Imperial authorities. The former date was selected partly with reference to the age of the moon, and partly with the object of avoiding as far as possible the anniversaries of great religious festivals. Beyond the somewhat sentimental interest which may attach to a statement specifying the whole population of the British Empire on a given day, the possible advantages of a simultaneous census would appear to be outweighed by the possible disadvantages of the time fixed for census day, at any rate from an Australian point of view. It would appear to be preferable for each part of the Empire to make its own arrangements concerning the date of its census. Such dates should, however, be as near to each other as circumstances will permit.
- (ii.) Uniformity in Other Matters. As regards certain subjects upon which comparisons can be made, there would seem to be no reason why the classification adopted should not be similar throughout practically the whole Empire. The number, sex, ages, conjugal condition, birthplace, and religion of the people could all form the object of an investigation on Imperial lines. The inquiry as to "Nationality" would probably present more difficulties, since the legislation of different Governments varies on this subject, while in the case of "Occupations" and "Infirmities," so many other considerations require to be taken into account that comparisons may at times be fallacious.
- (iii.) Dates of Census Conferences in Australia. There have been two Census Conferences held in Australia, viz., (1) one held at Hobart in March, 1890, and (2) the other held at Sydney in February, 1900. The efforts towards obtaining uniformity in census matters in Australia have chiefly been made in three directions, namely, (a) uniformity as to date of census, (b) uniformity as to scope of the inquiry made by the schedules, and (c) uniformity as to tabulation and presentation of results.
- 4. The Census Conference, 1890.—The early censuses of the Australian Colonies were based, in all essential features, upon the methods adopted in England, and though this had the good effect of conducing towards uniformity, it also resulted in the defects of English methods being to some extent reproduced in Australia. The first simultaneous census of the British Empire was that taken on the 3rd April, 1881. This date was fixed by the Imperial Government for the United Kingdom, India, and the Crown Settlements, and was assented to by the self-governing Colonies and Dominions. At the later censuses of the Australian Colonies the English system was followed as closely as local circumstances would permit, but less attention was paid than in the United Kingdom to some of the heads of inquiry, while considerably more was paid under other heads. The scheme of tabulation also generally agreed closely with that of England and Wales.

In course of time, defects in the methods of census inquiry became evident, more especially as regards classification and tabulation, and the sterility of the inquiry in respect of important economic conditions. With the object of remedying these defects, of discussing reforms, and for securing greater uniformity in methods of inquiry and in the final statistical tabulation of results, it was decided, in 1890, to hold a Conference of Australasian Statisticians.

(i.) The Colonial Conference, 1887. In the meantime the subject of the census of the British Empire had been considered incidentally at the Colonial Conference held in London in April, 1887. It was then stated that in July, 1886, the Registrar-General of Ireland had called attention to the want of information on the subject of census statistics, and had made proposals for a simultaneous census of the Empire under the direction of representatives of the United Kingdom, India, and the Colonies; also that the Royal Colonial Institute and the Imperial Federation League had made representations to the Colonial Office on the same subject. It

was further stated that the Registrar-General of England had reported generally against these proposals, and had expressed himself of the opinion that it was best to leave to each individual part of the Empire the choice of subjects of inquiry which should be included in its census, and the form in which the information, when collected, should be tabulated, so as to meet its own special conditions and requirements. The matter was discussed by the members of the Conference, but no decision was arrived at, the general feeling appearing to be that the census of the Empire should be taken at a given date, that uniformity of treatment should be secured when possible, and that this could best be obtained by the transmission of suggestions from the Imperial Government to the Colonial Governments two years before the date at which such census should be taken.

- (ii.) First Australian Census Conference, 1890. In pursuance of the outcome of the discussion just referred to, a circular despatch, dated the 28th February, 1889, was forwarded to the Governors of the respective Colonies, with a request that certain suggestions, enumerated by the Registrar-General of England, should be considered, and that the Colonial Office should be informed as to whether these suggestions met with the concurrence of the Colonial Governments. Early in the year 1890 it was decided by the Governments of several Australasian Colonies to hold a Census Conference in Hobart in March, 1890. The Conference was accordingly held, the Colonies represented being New South Wales, Victoria, South Australia, Tasmania, and New Zealand. Queensland, Western Australia, and Fiji were not represented, but expressed themselves generally as willing to fall in with the arrangements recommended by the Conference so far as circumstances might allow. The results of the Conference may be summarised as follows:—
  - (a) The subjects of inquiry and the principles upon which the householder's schedule should be framed were agreed upon, and a model schedule based thereon was drawn up and adopted.
  - (b) Forms for classifying the census returns under the several heads of inquiry were decided upon, due regard being paid to the suggestions made by the Registrar-General of England as specified in the despatch of the 28th February, 1889, and
  - (c) Many minor points calculated to promote uniformity in the tabular statements published in the several Colonies were discussed and settled. As a result of this Conference the degree of uniformity attained in the censuses of 1891 of the Australasian Colonies was much greater than had previously been reached.
- 5: The Census Conference, 1900. At a meeting of the Premiers of the several Australasian Colonies held at Sydney in January, 1900, it was decided that a Conference of Statisticians should be held to arrange for the collection and compilation of the Australasian Census of 1901 upon a uniform basis, to be mutually agreed upon. In compliance with this decision a Conference took place in Sydney on the 26th February, 1900, and following days. The Colonies represented were—New South Wales, Victoria, Queensland, South Australia, Western Australia, Tasmania, and New Zealand. The business of the Conference consisted in discussing and agreeing to such measures as would lead to uniformity throughout Australasia in the following particulars:—(i.) The date of the census; (ii.) the scope of the inquiry; and (iii.) the methods of compiling the results.
- (i.) The Date of the Census. The practice in the United Kingdom and also on recent occasions in Australia had been to take the census on the night of the first Sunday in April; but as, on the occasion of the census of 1901, this date would fall on Easter Sunday, and the population would, consequently, be very much displaced owing to the holidays, it was agreed that to hold the census on that date would be very ill-advised. Eventually it was decided to fix the census for the 28th April, by which date it was considered that sufficient time would have elapsed after Easter for holiday-makers to have returned to their homes. This decision was, however, afterwards overruled by the Premiers, who came to the conclusion that, not-withstanding the recognised local objections, the census should be taken on the 31st March, the date which, on the recommendation of the Royal Statistical Society, had been fixed by the Imperial authorities for taking the census in the United Kingdom. The accuracy of the general result was probably not-seriously prejudiced by the adoption of this date.
- (ii.) The Scope of the Inquiry. Several suggestions were offered for adding to the number of heads of inquiry contained in the schedule, as adopted at the Conference of 1890; but as the majority of the members were of opinion that to overburden the schedule would probably prejudice the accuracy of the returns, only one addition was made, viz., that when a person was not born in the Colony in which he was enumerated, he was asked to state the length of time he had resided therein. The making of inquiries as to land, stock, and crops was left optional. The subjects of inquiry ultimately decided upon, thirteen in number, were as follows:—Name sex, age, conjugal condition, relation to head of household, occupation, sickness and infirmity, birthplace, length of residence in Colony, religion, education, materials of houses, and number of rooms in houses. It was decided that any person having an objection to furnish a reply as to his or her religious belief should be allowed to insert the word "object" instead of replying

to the inquiry. It was also agreed that, in addition to the above heads of inquiry, it should be optional for any Colony to obtain particulars with regard to—(a) Sunday-school teachers; (b) assessed annual value of dwellings and how occupied; and (c) year of marriage, and number of children, living or dead. An additional column was subsequently, with the concurrence of the other statisticians, included in the Western Australian schedule, asking for the name and place of the college or school attended by each child receiving instruction.

- (iii.) Methods of Compilation and Tabulation. The remaining duties of the Conference were to arrange a uniform method dealing with the classification, compilation, and tabulation of the information, so as to admit of direct comparisons being made between the results of the various Colonies. With this end in view certain rules, for the classification of particulars concerning which it was likely that differences of opinion might exist, were adopted, while a revised classification of occupations was approved.
- 6. Results of Conferences.—Briefly, the results of the Census Conferences of 1890 and 1900 were to bring about the adoption of a uniform procedure by which the census authorities throughout Australia agreed to institute the same inquiries on the same date, and to present the results in the various reports drawn up by them, as nearly as practicable, in the same manner. Although uniformity in the form of the schedule was attained, minor differences arose as to the interpretation of terms. It should be noted also that the method of presentation of the results differed considerably in the several colonies, that the results of all the inquiries were not tabulated for all the States, and that there was no co-ordinating authority to bring the results together so as to form a total for Australia. This, of course, was regrettable. At the census of 1911, the first census taken under the æqis of the Commonwealth Government, the control of the census of the whole of Australia was centralised in the Commonwealth Statistician, thus permitting of practically absolute uniformity in census methods being attained throughout the Commonwealth.

The advantages to be derived from making the task of regularly enumerating the people a Federal one are obvious. Only by means of centralised control was it possible to secure all the essential conditions for the presentation of thoroughly homogeneous statistics. Under such control it has been easy to obtain (a) substantial identity in the method of collection, (b) identity of categories under which the returns are to be tabulated, and (c) uniformity in the interpretation of terms and in the scheme of presenting the facts. The Commonwealth Census of 1911, apart from being more reliable by reason of this homogeneity, is of greater utility than preceding censuses, inasmuch as the complete totals given for all the six States are directly comparable in every way.

7. The Progressive Development of the Schedules.—The tabular statement on page 40 shews the progressive development of the census schedules in each of the States since their first censuses. The several States—New South Wales, Victoria, Queensland, South Australia, Western Australia, and Tasmania—are indicated by the letters "N," "V," "Q," "S," "W," and "T" respectively, and in each case in which any of the specified subjects of inquiry was instituted at a census in any of the States, the corresponding letter for that State is inserted in the table. When a subject of inquiry has been instituted in the censuses of all the States, the letter "A" is inserted.

It should be pointed out that the subjects of inquiry indicated are only those of a personal nature, and those referring to habitations. At various censuses additional inquiries were included as to land, live-stock, crops, agricultural implements, etc. Furthermore, the table is intended to shew only subjects of inquiry, and not the scope of the inquiries. Although, as pointed out in the preceding parts of this sub-section, practical uniformity in the form of the schedule was attained at the more recent censuses of the several States, yet both the nature and form of many of the inquiries have in the past varied considerably, both as among the several States and in the individual States themselves. It would not be possible in a table of convenient size to shew the precise nature and scope of the inquiries made at these censuses.

As regards the subjects of inquiry at the Commonwealth Census of 1911, twenty of these subjects are identical with those adopted by all the States at the last census. The only subject of inquiry omitted at the Commonwealth Census was that relating to "insanity or idiocy." Of the remaining subjects, one, viz., that relating to number of children and duration of marriage, was included in part, in so far as it related to children born to present marriage, in New South Wales and Victoria, but was extended at the Commonwealth Census to include a separate enquiry as to number of children from previous marriage. In addition the Commonwealth schedule included queries as to the following matters:—(a) In relation to buildings—(i.) the nature of the building, (ii.) whether the occupier is the owner, tenant, or rent purchaser, (iii.) the amount of weekly rent payable or rental value per week; and (b) in relation to persons—(i.) the race to which they belong, and (ii.) the date of their arrival in Australia.

# PROGRESSIVE DEVELOPMENT OF AUSTRALIAN CENSUS SCHEDULES.

				Relation-			No. of Children born to			Length		l	Habitation	ıs.			Sickno Infirm		Occup	ation.		Education	1.
Year.	Name.	Age,	Sex.	ship to Head of Family.	Civil Con- dition.	Conjugal Con- dition.		Birth- place.	Nation- ality.	of Resi- dence in Country	Occupied.	Un- occupied	Being Built.	Ma- terials.	No of Rooms.		Blind- ness and Deaf- mutism.	Insanity or Idiocy.	Nature.	Grade.	Read and Write.	Attend School.	Uni- versit
1828	N	N	N		N					N	NT.		i	1					!			<u></u>	<u> </u>
1848	wT	w1	w1		Т	Т					1	r T		N	• • • • •	Ns	• • • • •	• • • • •	N S	N			
1857	.v T	.v 1	.V T	v	т	.V T		v			37 7	VT	N	[N	• • • • •	N			N		N		
1859	w .	w.	w .		w .	w		. ,		[	. V	. v	· V · · · · T	·V T	·V···	.VT			.VT	.v	.v		.v
1861	NVQS. T	NVOS. T	NVOS T	VOS T		NVOS T	i,	TVOS T			w.	w.	w.		• • • • •	w .	• • • • • •		w .		w.		
1868			. 0						• • • • • •	· · · · s · · ·	s		• • • • • •			s.	S		s		s		
																							.vo
1881		A	Λ	46 ~	w.	42.5				5	· . QS · .	· G . · · · i	· · Q · · ·	· · · Q · · · ·		Q	s		Qs		Qs	Q	
	Q			44	** .	44			A	SW .	A	1 A :	VOSWT	Δ 1	ATTY CITYLES	Λ .			A .		A	Α	A
1891		A	Δ	Δ			• • • • • • • •	. Q			Q	· · Q · · ·	· · · Q · · · ·	· · · Q · · · · !		Q			Q		Q !	Q	Q
1901	A	A	Δ	7	• • • • • • • •	A	NV	A	A	· · · · · ·	A	A	A	A	A	A	A	A	$\mathbf{A}$	A	A	Α	A
1911	A	Ā	Α.	Α		A 1		A	A	A	A	A	<b>A</b> ;	$\mathbf{A}$	A	$\mathbf{A}$	$\mathbf{A}$	$A^2$	$\mathbf{A}$	A	Ā	Ā	Ā
	4	A	A	A	· · · · · · j	A	A	A	A	A	A	A	$\mathbf{A}$	${f A}$	A	$\mathbf{A}$ :	Α		A	Δ	Δ	Ā	Δ

First Commonwealth Census. In addition to the particulars specified, the schedule included the following:—(a) In relation to buildings—(i.) the nature of the building, (ii.) whether the occupier is the owner, tenant, or rent purchaser, (iii.) the amount of weekly rent payable or rental value per week; (b) in relation to persons—(i.) the race to which of each sickness and the cause of each accident.

2 Inquiry was made as to the descriptive name

8. Cost of Censuses.—The following table shews, so far as particulars are available, the cost of the censuses of Australia from 1871 to 1901:—

Australia.	_Cost	Ωf	Cenguges	1871	to	1901	_
rrusurana.	-oos	u	OCITOROGO.	1011	w	TOOL	

Particulars	N.S.W.	Victoria.	Queensland.	S. Aust.	W. Aust.	Tasmania.	C'wealth
		,	TOTAL (	COST.	<u></u>		
£ 1871	<b>£</b> 15,930	£ 11,460¹	<b>£</b> 8,649 <sup>2</sup>	£3	£ 3	£ 2,0714	£3
1881 1891 1901	21,318 34,290 35,913	$12,432^{1} \ 27,714 \ 31,678$	$12,149 \\ 21,935 \\ 26,191$	13,679 16,071	<sup>3</sup> <sup>3</sup> 11,993	$3,015 \\ 1,820^{5} \\ 3,767$	125,613
		COST P	ER PERSON	ENUMERA	TED.		
	d.	d.	d.	d.	d	d.	d.
1871	7.58	3.761	11.982	3	3	$4.88 \\ 6.23$	3
1881	6.81	$\frac{3.46^{1}}{5.02}$	13.74	3	3	$\begin{array}{c} \textbf{6.23} \\ \textbf{2.985} \end{array}$	;3
1891 1901	$\begin{array}{c} 7.27 \\ 6.36 \end{array}$	$\frac{5.83}{6.33}$	$\begin{array}{c} 13.37 \\ 12.62 \end{array}$	$10.24 \\ 10.62$	<sup>3</sup> 15×63	5.24	7,99

<sup>&</sup>lt;sup>1</sup> Cost of collection only, *i.e.*, amounts paid to enumerators and collectors. Further particulars not available. <sup>2</sup> In 1876. <sup>3</sup> Not available. <sup>4</sup> Census of 1870. Exclusive of amounts paid to enumerators, for which particulars are not available. <sup>5</sup> Exclusive of cost of tabulation and general expenses, for which particulars are not available.

These figures in all cases understate the actual cost of the Census, owing to the exclusion in most instances of the cost of printing, and preparation of plans, as well as rental value of premises occupied by Census staff.

### SECTION 2.--NEW SOUTH WALES.

1. Musters and Enumerations in Early Days.—As already stated, census returns in one form or another have existed in Australia ever since the first settlement was established in 1788, the early enumerations being called "musters." Their main object appears to have been that of furnishing a basis upon which the probable victualling and other requirements of the infant colony could be estimated. During the early days of colonisation, the "musters" were of frequent occurrence, but the actual results of only a few have been preserved. They were carried out by requiring the inhabitants to attend on a certain day at a specified place in their respective The results obtained by such means do not appear to have been very reliable, as frequent references either to the number of persons estimated to have been unaccounted for or to the number of unrecorded deaths are made in the existing reports dealing with them, while successive enumerations recorded by the same individual in some cases appear to be inconsistent. The earliest "musters" were taken by the Governor himself, assisted by the Deputy Commissary-General; subsequently this duty was delegated to the Lieutenant-Governor; and still later to the Magistrates of the different mustering districts. The earliest of the "musters" was held in 1788, soon after the "First Fleet" arrived in Sydney Cove, and they were repeated, probably at first frequently, perhaps weekly, and afterwards at intervals of not more than a year, from 1788 An interval of three years then occurred, followed by the census of 1828, which may be considered as the first regular census taken in Australia. A complete account of the early "musters," so far as records have been preserved, may be found in the Statistician's Report on the Eleventh Census (1891) of New South Wales.

The number of persons debarked from the "First Fleet" in January, 1788, was probably 1035. By the end of the year 1825 the estimated population of Australia (including Tasmania) had increased to 52,505.

2. First Regular Census, 1828.—In connection with the first regular census in Australia, viz., that taken in New South Wales in November 1828, the Governor and Council of New South Wales passed an Act (9 Geo. IV., No. 4), which made provision for ascertaining the number, names, age-groups, sex, civil condition of the inhabitants of the Colony, and also the number of horses, horned cattle and sheep, and the area of land located, cleared and cultivated. The census statement of 1828 gives also some particulars regarding the nominal religious professions of the population. as well as information as to habitations in the town of Sydney. The resident magistrates were required to superintend the work of collection in their respective districts, and a separate return had to be filled up for each householder by the constables or other competent persons appointed by the magistrates. The number of persons enumerated in New South Wales in November, 1828, was 36,598, but this was exclusive of the military establishment, numbering about 1400,

and of an estimated number of 2000 "runaway convicts in the bush," "persons who have no fixed place of residence," and "omissions which may have occurred in taking the census." The total population of the Colony would thus be brought up to 40,000, of which 10,815 lived in Sydney (town and district). At this census, taken in one day, the population, as regards age was divided into two groups, viz., over and under the age of 12 years. Particulars as to civil condition distinguished between free persons, pardoned, those holding tickets-of-leave, and other convicts.

The New South Wales Census of 1828 did not include Tasmania, which had already been constituted a separate Colony in 1825, but it included the Moreton Bay District (Queensland).

3. The Census of 1833.—After the taking of the census of 1828 a period of five years elapsed before another enumeration of the people was made. The Census Act of 1833 (4 William IV., No. 4) differed but little from the Act of 1828, but while retaining the inquiries relating to sex and age, it narrowed the enumeration of "classes" to two, viz., free people and convicts, and no provision was made in the Act to distinguish either those born free within the Colony or free immigrants from those who had become free by pardon, nor to distinguish those holding tickets-of-leave from other convicts, although this information appears to have been collected by the Justices of Petty Sessions, under whose direction the census was taken. In subsequent censuses, when the distinctions referring to civil condition were revived, the classes enumerated were as follows:—(a) Those who were born in the Colony, (b) those who had come free to the Colony, and (c) other free persons. The convicts were divided into (a) those holding tickets-of-leave, (b) those in Government service, and (c) those in private assignment. The last census in which reference was made to the civil condition (i.e., whether free or bond) of the people was that of 1851, when a decade had elapsed since the cessation of transportation.

The census of 1833 was taken on the 2nd September. The total population of the Colony on that date was 60,794, shewing an increase of 20,794 since the year 1828. The increase in population by immigration was 22,813, of which number 16,792 were convicts, and 6021 free persons. The growth in the population of Sydney was remarkable, the inhabitants of the town alone numbering 16,232, being an increase of 5417 on the population in 1828 of the whole town and district of Sydney.

Persons employed by the Justices in the collection of census returns were allowed 7s. 6d. per diem. During the taking of the census an effort was made to ascertain the population out side the surveyed boundaries, but the Act made no provision for any enumeration or estimation of aborigines.

4. The Census of 1836.—The Census of 1836 was taken under an Act (7 William IV., No. 1) similar in its scope and provisions to that under which the census of 1833 was taken, and was subject to the same limitations. The census was taken on the 2nd September, 1836, and the total number of inhabitants of New South Wales and Dependencies is recorded as 77,096, or an increase of 16,302 in three years. Since 1828 the population had almost doubled, having increased from approximately 40,000. During the latter period the total number of convicts despatched from the United Kingdom was 27,378, and of immigrants 10,634, making a total addition to the population from outside sources of 38,012. The population of the town of Sydney in 1836 was 19,729, shewing an increase of 3497 in three years.

The census statement of 1836 gives particulars of the population of the Port Phillip (Victoria) District, which appears for the first time with 224 inhabitants.

5. The Census of 1841.—This census shewed a marked advance over all previous enumerations, particularly inasmuch as more complete information was furnished as to the local distribution of the population, the tabulation of the results was on better lines, and more numerous age groups were adopted, viz., under two years, two and under seven, seven and under fourteen, fourteen and under twenty-one, twenty-one and under forty-five, forty-five and under sixty, and sixty and upwards. Other improvements were the classifications of the conjugal condition of the people and of the various callings of the industrial population. The Act (4 Vict., No. 26) under which the census of 1841 was taken differed only slightly from previous Census Acts, but special provision was made for enumerating the inhabitants of the undefined portions of the Port Phillip District and of the Commissioners' districts beyond the boundaries of locations. A supplementary clause was specially passed providing that it should not be compulsory for any person to supply the information asked for with regard to civil condition (i.e., whether bond or free). The classification of religions embraced the following denominations:—Church of England, Church of Scotland, Wesleyan Methodists, other Protestants, Roman Catholics, Jews, and Mahometans and Pagans. The industrial classification of the workers under their various callings marks the emergence of the Colony from its first condition purely as a penal settlement. The heads of classifications adopted were—(1) Landed Proprietors, Merchants, Bankers, and Professional Persons; (2) Shopkeepers and other Retail Dealers; (3) Mechanics and Artificers: 4) Shepherds and others in the care of sheep; (5) Gardeners, Stockmen, and Persons employed in Agriculture; (6) Domestic Servants; and (7) All other Persons. A census of habitations was also made for the first time for the whole colony, an enumeration of the houses in Sydney having been made at the census in 1828. The classification adopted in 1841 was—(1) Material, subdivided into (a) stone or brick, and (b) wood; and (2) occupied or unoccupied. The remuneration given to collectors for their services was fixed at 10 shillings a day for those employed on foot, and 15 shillings for those on horseback.

The census of 1841 was taken in March, and under the Census Act of that year New Zealand was expressly excepted from the operations of the Act, though it was not until May, 1841, that New Zealand was proclaimed a separate Colony.

The total population enumerated in 1841 was 130,856, giving an increase of 53,760 since the census of 1836. The population of New South Wales (proper) was 114,601, of whom 29,973 resided in the town of Sydney, as against 19,729 in that town in 1836. The population of Moreton Bay was 200, of Norfolk Island 2187, and of Port Phillip 11,738, while 2130 persons were engaged on colonial vessels.

Since the census of 1836 the progress of Australia had received a great stimulus from the work of exploration carried out by Sir Thomas Mitchell, McMillan, Strzelecki, and others, and from the consequent opening up to agricultural and pastoral development of various districts, among which may be especially mentioned the Gippsland district in Victoria, and the district called by Mitchell "Australia Felix" in the neighbourhood of the Loddon River. 1

6. The Census of 1846.—The census of 1846 was taken on the 2nd March, under an Act which was somewhat wider in its scope than that regulating the census of 1841. The schedule appended to the Act, besides providing for the enumeration of the inhabitants by wards in the case of cities and towns, set forth two new branches of inquiry, viz., "Education" and "Birthplace"; the classification under the heading "Occupation" provided for ascertaining the grade of employment as follows:—(a) Principal journeyman; (b) Apprentice; and (c) Hired or Assigned Servant; and the list of occupations was considerably lengthened; while a new subdivision—"Other Persuasions"—was added to the tabulation of "Religions." The inquiry as to civil condition (see par. 5, p, 42 hereinbefore) was again made not compulsory. As regards "Habitation," information was sought as to whether the houses were shingled or slated.

The scheme of tabulation for the 1846 census was much more elaborate than in any prior census of the Colony. Instead of five tables, as in the census of 1841, the results were presented in fifty-six tables. Under each head of inquiry a separate table was prepared for the chief localities. The Port Phillip District was enumerated by counties and Commissioners' districts, the populations of each ward of the town of Melbourne and of country towns and villages were given. The remainder of the Colony, viz., the Middle District and the Moreton Bay District, was subdivided into counties and Commissioners' districts, police districts, parishes in the County of Cumberland, the City of Sydney, its wards and suburbs, and country towns and villages.

The total population of New South Wales in 1846 was 189,609 persons, shewing an increase of 58,753 since the taking of the census in 1841. The population of New South Wales proper was 152,009, of the Port Phillip District 32,879, of the Moreton Bay District 2525, while 2196 persons were engaged on colonial vessels.

The total number of habitations enumerated in 1846 was 31,761, as against 16,776 in 1841. The Port Phillip District contained 5198 houses in 1846, as against 1490 in 1841, and the Moreton Bay District 316. The total number of houses in New South Wales proper was 26,247.

7. The Census of 1851.—This census was taken on the 1st March, 1851, under the authority of an Act (14 Vict., No. 18) which was practically a copy of the preceding Census Act. The subjects of inquiry were the same as at the census of 1846. The inquiry as to civil condition was again not compulsory, and was included in the census of 1851 for the last time.

The total number of persons enumerated was 268,344, of whom 178,668 resided in New South Wales proper, 8575 in the Moreton Bay and Queensland Squatting Districts, and 77,345 in the Port Phillip District, while 2708 persons were engaged in the colonial marine, were travellers, or in military service, and 1048 persons were on board British and Foreign vessels in port. The total number of houses in New South Wales proper was 30,641, and in Moreton Bay and other Queensland Districts was 1021.

This was the last census taken before the separation of Victoria on the 1st July, 1851.

8. The Census of 1856.—The census was taken under the authority of an Act (19 Vict., No. 5) which differed but slightly from the preceding Census Act, and was the first census of New South Wales supplemented by a General Report.

The census of 1856 was taken on the night preceding Saturday, the 1st March, and the results were tabulated generally on the same basis as had been adopted for the tabulation of the 1846 and 1851 censuses. After the publication of the General Report the population of the Colony was tabulated for the first time according to Electoral Districts, of which there were 34, comprising counties, pastoral districts, boroughs, and towns. The necessary sub-divisions of the Colony numbered about 400.

<sup>&</sup>lt;sup>1</sup> See "Official Year Book of the Commonwealth," No. 2, 1901-1908, pp. 25-6.

At the taking of this census, Police Magistrates, Crown Lands Commissioners, and Benches of Magistrates were relieved of the duty previously imposed upon them of making abstracts of returns.

- (i.) Payment of Collectors. The allowance to collectors was raised to 20 shillings per diem for those employed on foot, and to 25 shillings for those on horseback. This was double the rate in the case of collectors on foot paid in 1851, but it was due to the general rise in wages throughout Australia consequent on the gold discoveries. The total number of collectors employed was 300.
- (ii.) Population Enumerated. The total population enumerated at this census was 269,722, of which number 249,282 belonged to New South Wales, as defined by its present limits, and 16,907 to what is now known as Queensland, while the undefined and unclassified population amounted to 3533. The population of Sydney and suburbs was 69,173. A considerable increase was shewn since the last census in the number of houses. In New South Wales proper the number had increased from 30,641 to 39,373, and in the Moreton Bay and other northern squatting districts from 1021 to 2106.
- (iii.) Scope of Census. The scope of the inquiry at the census of 1856 was practically the same as at the preceding census; the heads of classification were, however, extended in certain respects. The table giving the occupations of the people was enlarged by the addition of six new heads of classification, and the educational condition of the people was taken in combination with the more important religious denominations. With regard to the birthplaces of the people, the tables for 1856 were amplified, so as to distinguish those born in the United States of America, China, Germany, and France, from which countries a considerable number of immigrants had been attracted by the discovery of gold, and by the prevalent high rate of wages.
- 9. The Censuses of 1861, 1871, and 1881.—In 1859 letters patent issued on the 6th June constituted what were then known as the Moreton Bay and Northern Squatting Districts, together with the reputed County of Stanley, a separate Colony under the name of Queensland. The census of New South Wales, therefore, refers henceforward only to what constitutes the State of New South Wales at the present day, including the Federal Territory at Canberra.
- (i.) Simultaneous Census of British Empire. The census of 1861 was taken on the 7th April under the authority of an Act (24 Vict., No. 5) which provided that the day of enumeration should be identical with that chosen for the United Kingdom. The other Colonies forming the Australasian group, with the exception of Western Australia and New Zealand, also adopted this day. In 1871, of the Australasian Colonies only New South Wales, Queensland, Victoria, and South Australia adopted the Imperial date, but in 1881 all the Australasian as well as most of the other Colonies fell into line and the first simultaneous census of the British Empire was taken. Practically simultaneous censuses were also taken in 1891, 1901, and 1911.
- (ii.) The Schedules. In 1861 various minor alterations were made in the schedule, such as the insertion of an inquiry as to infirmity (blindness and deafmutism), and the relationship, if any, of the person enumerated to the head of the family. The schedules used at the census of 1871 and 1881 (taken under Acts 33 Vict., No. 12, and 44 Vict., No. 2 respectively) did not differ in any material point from that used in the census of 1861. Education in relation to Religion, tabulated for the first time in 1856, is not presented in the census of 1861, and does not again appear until 1881. In 1871 the tabulation as to education was separately carried out for Chinese and aborigines, the latter being specially noticed for the first time.

In 1861 the information as to roofing material was omitted, but inquiries were instituted for the first time with regard to the number of rooms in each dwelling. In 1871 the distinction of "iron" as a building material was no longer made, and information as to the number of rooms was not collected. In that year, however, the inhabited were distinguished from the uninhabited dwellings, a distinction neglected in the tabulation of the census of 1861.

(iii.) Divisions and Sub-divisions. In 1861 the information was collected according to registry districts, of which there were 78, the district registrars of the Colony acting as enumerators. There were employed on the work 80 enumerators and 464 collectors. The results were subsequently presented in registry districts, in police districts, in electoral districts, (in accordance with the Electoral Act of 1858), in counties and pastoral districts, in towns and villages, in parishes of the County of Cumberland, and in municipalities, which had recently been constituted under the Municipalities Act, 1858. In 1861 the rate of payment to collectors on foot was reduced from what it had been in 1856, namely, 20 shillings a day, to from 15 to 20 shillings a day; the rate paid to collectors on horseback remained the same, namely, 25 shillings a day. In 1871 the same plan was adopted with regard to divisions and sub-divisions, and the whole of the Colony was, for the purposes of enumeration, divided into 91 districts, corresponding with the registration districts already established, the boundaries of some of which were altered for the convenience of the work, so as to give as nearly as possible a maximum population of 10,000 inhabitants, in order that such area might be conveniently placed under the superintendence of one person acting as an enumerator. The divisions of the Colony under which the information was grouped in 1871 were similar to those adopted in 1861. The census results of 1881 were destroyed by fire, and only a number of summary tables in the hands of the Government Printer were preserved. The results of the census were arranged according to electoral districts, as defined by the Electoral Act, 1880, but no tabulation of the population in counties had been made before the destruction of the documents.

(iv.) Tabulation. In 1861 a more complete tabulation of the ages of the people was introduced, the number of each age for successive years up to fifteen being given, and then in progressive quinquennial periods up to eighty, the last group embracing persons of eighty years of age and upwards. The table devoted to "Conjugal and Domestic Condition" was extended, and the branch of inquiry, "Houses and Other Residences," was tabulated in connexion with the information relating to "Conjugal Condition." The tabulation of "Occupations" in 1861 shewed some improvement upon that of 1856, and coincided in all material respects with the classification employed in England, and also with that generally adopted, with slight modifications to suit local requirements, by all the Australasian Colonies.

The general work of tabulation in 1861 was arranged according to the several divisions of the Colony, and was classified according to (a) Census or Registry districts, (b) Police districts, (c) Electorates, (d) Counties and Pastoral districts, and (e) Municipalities, towns, villages, and parishes in the County of Cumberland. In each of these series of districts the population was tabulated (a) by age, (b) by conjugal and domestic condition, (c) by occupation, (d) by birthplace (e) by religion, and (f) by education.

The tabulation of the results of the census of 1871 differed from that of 1861 in only a few details. The ages of the people were given in greater detail by the addition of two groups, while under the heading of "Religion" six new denominations were added. The details formerly classified under the head of "Conjugal and Domestic Condition" now appeared under that of "Social Condition," and the particulars were tabulated in age groups. The presentation of the details under the heading of "Occupations" was an improvement upon that adopted in 1861. The people were arranged in 13 classes, which were divided into sub-orders, in which the various trades and professions therein embraced were consecutively enumerated. The tabulation of the people in counties in 1871 presented a considerable number of changes owing to the inclusion of five new counties, the greater portion of the population of which had been included in the old squatting districts. The number of towns enumerated at the census of 1861 was 105, and at the census of 1871 was 167, both exclusive of the city and suburbs of Sydney. In 1871 twenty-five new municipalities were included.

The tabulation in 1881, as far as it went, was practically the same as in the preceding census, although a few unimportant changes were made in the classification.

- (v.) The Populations Enumerated. The total population enumerated was 350,860 at the census of 1861; 503,981 at the following census; and 751,468 in 1881. The figures here given for 1871 and 1881 include full-blooded aboriginals which are excluded in the table on p. 36. The population of Sydney and suburbs increased from 95,789 in 1861 to 137,776 in 1871, and to 224,939 in 1881.
- 10. **The Census of 1891.**—With the object of obtaining uniformity in the censuses of 1891 of the Australasian Colonies, a Conference of Statisticians was held at Hobart in March, 1890. This Conference has already been referred to in some detail (see p. 37); it will suffice to mention here that as a result of the resolutions passed at that Conference, practical uniformity was secured in all the Australasian Colonies as to (i.) date of census; (ii.) subjects of inquiry; and (iii.) tabulation of results.
- (i.) Date of Census. The date upon which it was decided to take the census (the 5th April, 1891) was determined by the British Government for the United Kingdom, India, and the Crown settlements, and was assented to by the various self-governing Colonies, although it was not always the most convenient date. Only in India, Ceylon, Hong-Kong, Borneo, and in some outlying parts of Canada was it found impracticable, chiefly for climatic reasons, to take the census in the month of April. The relative advantages and disadvantages in taking the census simultaneously throughout the British Empire is referred to in an earlier part of this Report (see p. 37).
- (ii.) Subjects of Inquiry. The Act (54 Vict., No. 31) under which the census of 1891 was taken in New South Wales appointed the day upon which the census was to be taken, and gave the Government Statistician of the Colony the authority necessary to carry out the various objects of the census. The Act provided also for the collection of Industrial and Commercial Statistics, and of particulars relating to live-stock, crops, and occupation of lands. The Householders' Schedule did not form part of the Act, but was provided for by regulation; it corresponded closely with the schedule drafted by the Hobart Conference and differed but little from the schedule used at the previous census. The items of inquiry were:—(a) Name and surname, (b) relation to head of family, (c) conjugal condition, (d) sex, (e) age, (f) occupation, (g) whether employer, employed or working on own account, (h) birthplace, (i) religion, (j) education, (k) sickness or infirmity, and (l) particulars relating to habitations.
- (iii.) Divisions and Sub-divisions. For the purpose of taking the census of 1891 the Colony was divided into 100 districts, the areas of some of which were of considerable size, particularly those situated in the western parts of the Colony. The largest census district was Bourke, with an area of about 22,680 square miles. The most populous was the second Sydney Census District, comprising the wards of Cook, Phillip, and Denison, with a population of over 60,000. Each census district was placed under the charge of an officer, called an enumerator, who was nominated by the magistrates.

- (iv.) Number and Payment of Collectors. Each enumerator's district was divided into collectors' districts. The total number of collectors employed was 1203. A journey of from 30 to 35 miles was considered a fair day's work for a collector on horseback, and for those on foot about 12 miles. The rate of payment sanctioned was 10 shillings a day for those on foot, and 20 shillings for those on horseback. Special rates up to 40 shillings a day were paid to horsemen in certain districts. The census in some localities had to be taken by men in boats, and in the few instances in which they were thus employed, 15 shillings a day was paid.
- (v.) Tabulation of Results. For tabulation purposes, cards were used, the whole of the returns being transferred from the schedules. The varieties of card employed were four in number, viz.:—one for each male, for each female, for each married couple, and for each habitation. Generally the scheme of tabulation was the same as for the census of 1871, but the tables were considerably elaborated, and an exhaustive General Report was issued.
- (vi.) Population Enumerated. The total population of the Colony inclusive of aboriginals had increased from 751,468 in 1881 to 1,132,234 in 1891, and the population of Sydney had increased during the same period from 224,939 to 383,283.
- 11. **The Census of 1901.**—The Census Act (64 Vict., No. 65) of 1900 provided that the householders' schedule should contain particulars shewing (a) the name, sex, age, condition, duration of marriage, number of children born to each marriage, relation to head of household, profession or occupation, sickness or infirmity, religion, education, and birthplace, and (when the person was born abroad) length of residence in New South Wales, and nationality of every person who abode in each dwelling on the night of the census, and (b) the materials of the dwelling and the number of rooms contained therein. The Act also provided for obtaining certain particulars relating to live-stock, crops, the occupation of land, and also industrial statistics. A General Report of this census was commenced but was not published. The scope of the inquiry and the census methods adopted were similar to those in use at the preceding census.
- (i.) Divisions and Sub-divisions. The whole State was divided into enumerators' districts in the same way as had been done in previous censuses, the districts being apportioned in the Census Office. Natural or fixed boundaries were adopted as far as possible, each district being no larger than it was thought possible for one man to conveniently supervise. The collectors' districts were apportioned by the enumerator, and 95 enumerators and 1379 collectors were employed.
- (ii.) Tabulation. Generally the method and scheme of tabulation were similar to those adopted in 1891. The greatest number of persons employed as tabulators at any one time was 64, the average number while the work was in full progress being about 40.
- (iii,) Population Enumerated. The total population, inclusive of aboriginals, had increased from 1,132,234 in 1891, to 1,359,133 in 1901, and that of Sydney and suburbs from 383,283 to 481,830,

### SECTION 3.—VICTORIA.

1. Early Enumerations.¹—The first permanent settlement of Victoria (first known as the Port Phillip District of New South Wales) was made in 1835 by John Batman, who was shortly after followed by John Pascoe Fawkner.² The enumerations of the people taken up to the time of the constitution of the Port Phillip District as a separate Colony (1851) were generally, though not invariably, carried out in conjunction with the censuses of New South Wales.

An officer, sent in 1836 by Sir Richard Bourke, then Governor of New South Wales, to report upon the newly settled Port Phillip District, ascertained that on the 25th May, 1836, the population, exclusive of aborigines (of whom no estimate was made), consisted of 177 persons. A later return, made by Captain Lonsdale, the first Resident Magistrate of the District, shews that the population on the 29th September, 1836, was 224. Two years later, by which time a considerable stream of migration chiefly from New South Wales and Tasmania had set in, it was decided to take a census on the 12th September, 1838, as a result of which the population was found to number 3511.

2. The Censuses of 1841, 1846, and 1851.—These enumerations were made in the Port Phillip District in connexion with the New South Wales Censuses, to which reference has already been made (see Section 2, §§5, 6, 7, above). In 1841 the population was returned at 11,738; it had increased to 32,879 in 1846, and to 77,345 in 1851. The census of 1851 was taken on the 2nd March before the constitution of the Port Phillip District as a separate Colony, which event did not take place until the 1st July, 1851.

<sup>&</sup>lt;sup>1</sup> See Census Report of Victoria, 1891. <sup>2</sup> Mr. Edward Henty had established a station at Portland Bay in November, 1834, but this can hardly be said to have led to the permanent settlement of the Port Phillip District.

- 3. The Census of 1854.—This was the first census taken of Victoria as a separate Colony. Chiefly in consequence of the gold discoveries in 1851, a large influx of population had taken place, and it was therefore determined to enumerate the population on the 26th April, 1854. An Act (17 Vict., No. 9) was passed providing for the taking of the census, and the various forms of schedules employed in the 1841 census of the United Kingdom were adapted to the circumstances and requirements of the Colony, which was divided into 26 districts, each in charge of an enumerator. Police magistrates were appointed enumerators for their respective districts, excepting in Melbourne, where the Town Clerk acted as enumerator. The number of subenumerators employed was 194, their rate of pay depending on the nature and extent of the country they had to traverse, and on the number of people to be enumerated. The heads of inquiry comprised age, sex, religion, conjugal condition, education, and occupation. Returns were also collected as to area of land alienated. The population was tabulated according to counties and pastoral districts, electoral districts and provinces, goldfields, seaport towns, rural and mining districts, and towns and villages. The population enumerated was 236,798, including 2500 aboriginals, and the estimated cost of the census was £11,000.
- 4. The Census of 1857.—The Victorian goldfields continuing to cause a considerable accession of population, another census was taken after an interval of three years, viz., on the 29th March, 1857.

For the purpose of making the preliminary arrangements for the census of 1857, a Commission was appointed by the Government to prepare the form of the householders' schedule, and to frame regulations and instructions for the guidance of the officers engaged in carrying out the provisions of the Census Act. The Commissioners obtained the co-operation of the municipal and other local authorities, and were thus enabled to frame a scheme of sub-divisions of the Colony, whereby the greater part of the enumeration was taken and supervised by means of local agency. The enumerators were selected by the local authorities, but were appointed by, and responsible to, the Government. A new and useful regulation framed by the Commissioners was that which required the sub-enumerators to fill up a return shewing the name and residence of every householder with whom he had left a blank schedule.

- (i.) Divisions and Enumerators. The Colony was divided into 60 census districts, which were again subdivided into 907 sub-enumerators' districts. The total number of persons employed in collecting the returns was 1005, of whom 60 were enumerators, 930 sub-enumerators (of whom 477 had to perform their duties on horseback), and 15 were Chinese interpreters or assistant sub-enumerators.
- (ii.) Scope of Inquiry. The schedule used at the census of 1857 contained 10 columns under the following heads of inquiry:—(a) Name and surname, (b) Relation to head of household, (c) Conjugal condition, (d) Sex, (e) Age, (f) Rank, profession, or occupation, (g) Where born, (h) Religion, (i) Education, and (j) Description of house. The tabulation of results was carried out on a similar plan to that adopted in 1854.
- (iii.) Population Enumerated and Cost of Census. The total population at the census of 1857 was 410,766, including 1768 aborigines. The cost of the census, exclusive of printing, postage, and of the expenses of the central office, was £15,242.
- 5. The Censuses of 1861, 1871 and 1881.—The Census Act of 1861 (24 Vict., No. 120) provided that the census should be conducted entirely by the Registrar-General, and not by a Commission as had been the case in the preceding census. This provision was also continued in the subsequent Census Acts of Victoria. The census of 1881 was taken under Act 44 Vict., No. 667. The census of 1861 was taken on the 7th April; that of 1871 on the 2nd April; and that of 1881 on the 3rd April. At the census of 1881 the "Card System" (see p. 15 hereinbefore) of tabulation was first used in Victoria.
- (i.) Divisions and Sub-divisions. In 1861 and 1871 the general method of dividing the Colony into districts for census purposes was the same as that adopted in 1857. In 1861 the Colony was divided into 67 census districts; in 1871 it was divided into 60 districts. In 1876 the Electoral Act Amendment Act was passed and the electoral districts upon which the enumerators' districts at previous censuses were based were changed. In 1881 the Colony was therefore entirely redivided for census purposes, so that the census districts might fit in as far as possible with the counties, which are permanent divisions. The number of districts into which the Colony was divided for census purposes in 1881 was 78.
- (ii.) Enumerators and Sub-Enumerators. In 1861 there were 67 enumerators appointed, their rate of pay ranging from £10 to £50; the number of sub-enumerators employed was 1021. The maximum rates, which in the first instance were sanctioned by the Government to be paid to sub-enumerators, were 25 shillings a day to those on foot, and 50 shillings to those on horse back. In certain districts it was, however, found impossible to engage suitable men on foot at a lower daily rate than 30 shillings. In 1871 there were 60 enumerators and 1568 sub-enumerators. The rate of payment to enumerators was practically the same as in 1861, but the rate for sub-enumerators was reduced to 15 shillings per diem for those acting on foot, and to 30 shillings per diem for those on horseback. In 1881 there were 78 enumerators, and 1869 sub-enumerators.

The payments of the enumerators were fixed according to the size and presumed population of the different districts, the original amounts varying from £12 to £35. Many of the enumerators were, however, granted extra allowances, the average amount actually paid being about £28. The rate of payment sanctioned to sub-enumerators was 10 shillings per diem to those acting on foot, and £1 per diem to those on horseback.

- (iii.) Scope of Inquiry. The nature of the information sought to be obtained at the censuses of 1861, 1871, and 1881 was prescribed in the householders' schedules appended to the Census Acts. In 1861 it comprised the same heads of inquiry as in 1857, and an additional column was introduced for "health," in which entries were to be made of cases of sickness or accident, and of the numbers of deaf and dumb, and blind. In 1871 the schedule was identical with that of 1861, but columns were added for area of land in occupation, for holdings of more than one acre in extent, and for numbers of live-stock kept, while the inquiry as to Rank, Profession, or Occupation was supplemented by a column specifying past occupation. The scope of the inquiry at the census of 1881 was the same as in 1871.
- (iv.) Population Enumerated. The population enumerated in 1861 was 540,322, of whom 1694 were aboriginals. By 1871 the number of inhabitants had increased to 731,528, of whom 1330 were aboriginals, and by 1881 it had increased to 862,346, of whom 780 were aboriginals. The total population of Melbourne and suburbs in 1861 was 126,536; by the year 1881 the number enumerated in Greater Melbourne had increased to 282,947. The total number of inhabited dwellings in Victoria was 128,617 in 1861; 151,478 in 1871; and 170,086 in 1881.
- 6. The Census of 1891.—The Census of Victoria, 1891, as well as that of all the other Australasian Colonies, was taken as referring to midnight on Sunday, the 5th April of that year, which time corresponded to that appointed for enumerating the population of the United Kingdom and most of the outlying portions of the British Empire.
- (i.) Scope of Inquiry. The Act (54 Vict., No. 1171) under which the census of 1891 was taken was similar to the previous Census Acts, but the householders' schedule was not, as on former occasions, appended to the Act, which embodied only the heads of inquiry to be arranged in the schedule according to the method agreed upon at the Hobart Conference. For the information of the Educational Department a form of schedule was attached to the Act, in which provision was made for obtaining information as to the name, sex, and place of residence of every child under 15 years of age, also whether it was receiving education, and, if so, at what place.
- (ii.) Divisions and Sub-divisions. The Electoral Districts, 84 in number, were taken as the basis for the census districts, of which there were in all 90. Each census district was divided by the enumerator into sub-districts of such size that in populous areas the work of enumeration could be completed in three days, viz., one day for delivering and two days for collecting the schedules.
- (iii.) Enumerators and Sub-enumerators. The enumerators were 90 in number, and they were paid sums ranging from £20 to £25 in town districts, and from £25 to £70 in country districts. In some cases special allowances were made. The number of sub-enumerators employed was 2330, of whom 976 acted on foot, 1310 on horseback, and 44 partly on foot and partly on horseback. There were also 45 interpreters to the Chinese. The rate of payment to sub-enumerators was the same as in 1881, viz., 10 shillings a day to those on foot, and £1 a day to those on horseback. Each sub-enumerator was allowed half a day at the foot rate for making up his returns. Four of the sub-enumerators were females.
- (iv.) Tabulation. The scheme of tabulation was in accordance with the terms of the agreement arrived at by the Census Conference of 1890 (see p. 37). During the census compilation, the largest number of extra clerks attached at any one time was 65, but the employment of so many only lasted for about five months. The card system of tabulation was used.
- (v.) Population Enumerated. The population of Victoria enumerated on the 5th April, 1891, was 1,140,405, of whom 565 were aboriginals. The population of Melbourne at the same date was 490,896. The total number of habitations in Victoria was 241,560, of which 224,021 were inhabited, 15,846 were uninhabited, and 1693 were being built.
- 7. The Census of 1901.—This census was taken under the provisions of the Census Act, 1900 (64 Vict., No. 1669), on Sunday, the 31st March, 1901. No General Report of this census was issued, and the available information with regard to general census methods is somewhat meagre. Generally the system of preparation for, and the method of collection and tabulation at the 1901 census were carried out on much the same lines as in the case of the 1891 census.
- (i.) Divisions and Sub-divisions. With regard to the division of the State into census districts the basis as adopted in 1891 was taken for the 1901 census, viz., the State Electoral districts were treated as enumerators' districts excepting in four cases; these latter, being too large, were each subdivided into two or more census districts.

- (ii.) Enumerators and Sub-enumerators. The number of enumerators employed was 94, and of sub-enumerators 2235, in addition to 37 interpreters to the Chinese. Enumerators were paid from £20 to £65; sub-enumerators on foot were paid 10 shillings a day, on bicycle 14 shillings a day, and on horseback 18 shillings a day; and interpreters were paid 10 shillings a day. Six of the sub-enumerators were women.
- (iii.) Scope of Inquiry and Method of Tabulation. The subjects of inquiry specified in the Act were as follows:—(a) name, sex, age, condition as to and duration of marriage, number of children born to each marriage, relation to head of the household, profession or occupation, sickness or infirmity, religion, education, and birthplace, and (where the person was born abroad) length of residence in Victoria, and nationality of every person who abode in each dwelling on the night of the census day; (b) the materials of the dwelling and the number of rooms contained therein. Provision was also made for the collection of statistics as to the area, tenure and cultivation of occupied land held in connexion with or in the vicinity of the dwelling occupied and of the numbers, kinds, sex, age, and breed of live-stock kept thereon.
- (iv.) Population Enumerated. The population of Victoria increased from 1,140,405 in 1891 to 1,201,341 in 1901; of the latter number 271 were aboriginals. The population of Melbourne and suburbs increased during the same period from 490,896 to 496,079, and the number of habitations in Victoria from 241,560 to 253,656.
- 8. Cost of Collection 1857 to 1901. The cost of taking the census on the last six occasions so far as payments to enumerators and sub-enumerators are concerned was as follows. In addition to the amounts specified, considerable sums were expended on each occasion on clerical labour, office buildings, fittings and furniture, stationery, printing, advertising, railway fares, and other charges.

	4	AMOUNTS PAID.			
Year.	To Enumerators.	To Sub-enumerators.	Total.	Population.	Cost of Collection per Head.
	£	£	£	No.	Pence.
1857	1,856	13,386	15,242	410,766	8.91
1861	1,936	12,966	14,902	540,322	6.62
1871	1,643	9,817	11,460	731,528	3.76
1881	2,144	10,288	12,432	862,346	3.46
1891	2,713	11,631	14,344	1,140,405	3.02
1901	2,693	11,258	13,951	1,201,341	2.78

Victoria.—Amounts Paid to Enumerators and Sub-enumerators, 1857 to 1901.

## SECTION 4.—QUEENSLAND.

- 1. Early Enumerations in Moreton Bay District.—The first permanent settlement in the Moreton Bay District dates from 1824, when a penal station was established near the present site of the town of Brisbane. In the same year the district of Moreton Bay is specified in the returns of the "muster" held in New South Wales (of which the Moreton Bay District then formed part) with a population of 33. The first proper enumeration of the inhabitants of the district was carried out in connection with the New South Wales Census of 1828, when the population of the distant and penal settlements in the Colony was stated to be 1337. The population of the Moreton Bay and Northern Squatting Districts was enumerated at the subsequent censuses of New South Wales, until the year (1859) of the constitution of Queensland as a separate Colony. These censuses have already been referred to. (See Section 2, New South Wales.)
- 2. First Census of Colony of Queensland, 1861. The first census of the Colony of Queensland was taken under an Act of Council (24 Vict., No. 5) on the night of the 7th April, 1861. The Colony was divided into 17 enumerators' districts, coinciding with the Police or Commissioners' districts, and into 131 collectors' sub-districts. The subjects of inquiry embraced sex and age, education, conjugal condition, habitations (materials), birthplace, religion, and occupation. In addition to these subjects the collectors were required to obtain returns of areas of land under cultivation and of numbers of live-stock. The total population enumerated at the census of 1861 was 30,059.

- 3. The Census of 1864.—This census was taken under a special Act on the 1st January, 1864. Police districts (the boundaries of which coincided with registration districts) were, as before, used as census districts; each municipality was, however, excised from its particular district, and made into a separate census district. The total number of enumerators' districts was 31, and of collectors' districts was 142. The amount paid to enumerators was £229, and to collectors £1960, the total cost of the census being £2671. The scope of the inquiry was practically the same as in 1861. Since the previous census the occupied area of the Colony had extended considerably and the population had increased from 30,059 to 61,467.
- 4. The Census of 1868.—The third census of Queensland was taken on the 2nd March, 1868, under a special Act (31 Vict., No. 32). The same plan for the division and subdivision of the Colony was adopted as at previous censuses. Town Clerks in municipalities and Police Magistrates, Lands Commissioners, or Clerks of Petty Sessions in other districts were appointed enumerators. The total number of enumerators' districts was 50, and of collectors' districts 191. The amount paid to enumerators was £360, and to collectors £2811, the total cost of the census being £3750. The subjects of inquiry were the same as at the previous census, and the total population enumerated was 99,901.
- 5. The Census of 1871.—This was the last census taken under the provisions of a special Act (34 Vict., No. 23) before the Quinquennial Census Act, 1875, came into force; it was the first of a series of five quinquennial censuses taken in Queensland in 1871, 1876, 1881, 1886, and 1891, followed by the census of 1901, the Quinquennial Act having been suspended in 1896.
- (i.) Divisions and Sub-divisions. At the census of 1871 an important change was made with regard to the division of the Colony for census purposes. On former occasions the well-known boundaries of established police districts and municipalities were adopted, but on this occasion the Act required that the boundaries of pastoral districts and parishes should be followed, as far as practicable, in defining the census districts and sub-districts. The Colony was divided on that basis into 42 enumerators' districts, and into 213 collectors' sub-districts.
- (ii.) Scope of Inquiry and Tabulation. Both the scope of inquiry and the scheme of tabulation were similar to those adopted at previous censuses. The "Occupation" column was supplemented by provision for specifying cases where a person was prevented from following his usual calling through sickness or accident. The aboriginals in the Colony were not included in this or in any previous census of the Colony.
- (iii.) Population Enumerated. The total population enumerated was 120,104, of which number 18,455 lived in Brisbane and suburbs.
- 6. Censuses of 1876, 1881, 1886, and 1891.—These censuses, as well as the succeeding census in 1901, were all taken under the provisions of the Quinquennial Census Act 1875 (39 Vict., No. 2). This Act provided that a census of the population of Queensland should be taken on the 1st May, 1876, and on the same day in every fifth year thereafter, and that every such census should contain the particulars specified in the schedule appended. These particulars were the same as those contained in the schedule used in the previous censuses. Act also provided that the boundaries of pastoral districts and parishes should be followed as far as possible in defining the census districts, thus preserving the provisions of the Census Act of 1871 in this respect. The Quinquennial Census Act was amended in 1889 by an Act which provided that in addition to the particulars specified in the principal Act, the census should contain such further particulars as might be prescribed by regulations. In 1880, 1890, and 1900 special Acts were passed providing that the census should be taken on 3rd April, 1881, In 1880, 1890, the 5th April, 1891, and the 31st March, 1901, respectively, so as to be simultaneous with the censuses in other parts of the British Empire, and in 1895 another Act was passed postponing the taking of the census due in 1896 for a period of five years. In 1891 the "card system" was adopted for tabulating the returns; at previous censuses the particulars had been posted from the schedules on to tabulating sheets.
- (i.) Divisions and Sub-divisions. As the settled districts of the Colony extended it became necessary to increase the number of census districts, the boundaries of which were made to coincide as far as possible with the pastoral and parish boundaries. In 1876 the Registry districts were re-adjusted so as to make their boundaries correspond throughout with those of the census districts. Before the enumeration of 1881 it was thought necessary to again readjust the census districts and sub-districts, so as to make the subdivisional lines coincide with the outside boundaries of Divisions constituted under the Divisional Boards Act, 1880. In 1867 and 1881 there were 52 census districts. In 1886 the number of census districts was increased to 58, and these districts were again subdivided into collectors' districts much smaller than at the previous census. In 1891 practically the same arrangements were adopted as in 1886, the number of districts, however, being increased to sixty.

- (ii.) Enumerators and Collectors. The number of enumerators at the census of 1876 was 52, and they were paid each a fee of 4 guineas in addition to an amount calculated on the following basis:—five shillings per hundred persons enumerated up to one thousand; three shillings per hundred over a thousand, and not exceeding five thousand; and two shillings per hundred persons over five thousand. The number of collectors was 285, and they were paid, for men on foot 10 shillings a day, and for mounted men 15 shillings a day. Higher rates were, however, given in several cases. At the censuses of 1881, 1886, and 1891 enumerators and collectors were paid generally at the same rates as in 1876; in some districts, however, especially in those where horsemen had to travel long distances through uninhabited country, the rate of pay was much higher.
- (iii.) Scope of Inquiry. The scope of inquiry at the censuses of 1876, 1881, and 1886, was, in all essential particulars, as provided for in the Quinquennial Census Act, 1875. In 1880 an Act was passed giving power to make any alterations necessary to assimilate the form of the schedule to that used in the United Kingdom. It was not, however, considered that any alterations were necessary, as there was practically no difference in the forms of the schedule, except that the schedule used in the United Kingdom did not provide for inquiries as to religion or education, as shewn in the Queensland and other Australian Colonies schedules. In 1889 it was considered that the schedule prescribed in the Act of 1875 was not suitable to the requirements of the Colony, and an amending Act (referred to above) was passed providing that the schedule should be alterable at the will of the Governor in Council. Though Queensland was not represented at the Hobart Census Conference of 1890, a schedule nearly identical with the one approved by the Conference was adopted for the census of that Colony in 1891. The schedule adopted for the census of 1891 was practically the same as that used in New South Wales. The inquiries as to occupations and as to sickness and infirmity were extended, while the reply to the branch of inquiry as to religion was made optional.
- (iv.) Cost of Censuses. The cost of the census of 1876, exclusive of printing in the Government office, was £8649, or 11.98 pence per head. In 1881 the total cost was £12,149, or 13.74 pence per head; in 1886 it was £21,001, or 15.61 pence per head; and in 1891 it was £21,935, or 13.37 pence per head.
- (v.) Population Enumerated. The total population enumerated in 1881 was 213,525, as against 173,283 in 1876. In 1886 the total population enumerated was 322,853 persons; and in 1891 it was 393,718. The number of dwellings inhabited in 1891 was 78,429, and uninhabited 2224.
- 7. The Census of 1901.—The date of the ninth census of Queensland was fixed by special Act to be taken on the 31st March, 1901, so as to coincide with the date of the censuses in the United Kingdom and most parts of the British Empire. In the meantime the Sydney Census Conference of 1900 had taken place (see p. 38 hereinbefore) and all matters in connexion with the form of the schedule, the subjects of inquiry, and the methods of compilation, and the scheme of tabulation had been considered. This was the first census at which an account was taken of the aboriginals in Queensland.
- (i.) Divisions and Sub-divisions. The same scheme of division into census districts was adopted in 1901 as in 1891. Two additional census districts were, however, created, so that including one new Registration district, the whole of Queensland was divided into 63 census districts. An enumerator was appointed for each census district, the total number of collectors employed being 583.
- (ii.) Population Enumerated and Cost. The total population enumerated was 503,266, including 5137 full-blooded aboriginals, and 1533 half-castes; the number of dwellings was 100,610, of which 1670 were uninhabited. The cost of the census of 1901 was increased owing to the climatic conditions. Whilst a drought prevailed over the greater part of Western Queensland there were heavy rains in many of the coastal districts, and floods in the north. The rates of pay demanded by collectors was much in excess of those paid in 1891. The total cost of the census in 1901 was £26,191, equal to 12.62 pence per head of the total number of persons enumerated.

In 1905 a special Act was passed authorising the omission of the census which was due to be taken in 1906 under the Quinquennial Census Act, 1875.

(iii.) Scope of Inquiry and Tabulation. The scope of inquiry and scheme of tabulation were in all essential particulars the same as those adopted at the 1901 censuses of the other Australian States. The total number of persons employed in the work of tabulation, including the permanent staff, was sixty.

#### SECTION 5.—SOUTH AUSTRALIA.

- 1. **Introduction.**—On the 15th August, 1834, an Act (4 and 5 William IV., cap. 95) was passed by the British Parliament, creating South Australia a "province." The first settlers left London in February, 1836, and arrived in the new Colony towards the end of the same year. The first Governor, Captain Hindmarsh, R.N., arrived at Holdfast Bay on the 28th December. 1836, and on the same day the Province of South Australia was officially proclaimed. The first census was taken in 1844, when the population enumerated was 17,366. Information regarding the historical development of the census in South Australia is incomplete.
- 2. Dates of Censuses and Authority under which Taken.—The following statement shews in tabular form the dates of the several South Australian Censuses, together with the authority under which each enumeration was made.

South Australia.—Dates of Censuses a	and Authority	under which Taken.
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	Ordinance	or Ac	t.		Date Passed or Assented to.		Date Census Taken.
No. 13 of					3rd November, 1843 <sup>2</sup>		26th February, 1844
	$1845^{1}$				22nd July, 1845 <sup>2</sup>		26th February, 1846
,, 8 ,,	$1850^{1}$				11th June, 1850 <sup>2</sup>		lst January, 1851
,, 13 ,,	1854				15th December, 1854		31st March, 1855
,, 12 ,,	1859				1st September, 1859		1st April, 1860 <sup>3</sup>
,, 18 ,,	1860				17th October, 1860		7th April, 1861
,, 4 ,,	1865			[	4th August, 1865		26th March, 1866
	1870				21st September, 1870		2nd April, 1871
	1875				22nd September, 1875		26th March, 1876
	1880				11th August, 1880		3rd April, 1881
	1890				24th October, 1890	1	5th April, 1891
	1900				5th December, 1900		31st March, 1901

- <sup>1</sup> Ordinance. <sup>2</sup> Passed. <sup>3</sup> In the Report for 1861 a note states:—" A census taken in 1860; but owing to the temporary absence of a portion of the population and other disturbing influences, tending to an incomplete enumeration, the numbers then arrived at have been proved by the present census to have been erroneous and are consequently not referred to for comparison."
- 3. Census Methods.—Each of the first four censuses was carried out under the supervision of the Colonial Secretary, while the fifth was carried out by the Under Secretary of the Colony. For each subsequent census from that of 1861 to that of 1901 a Superintendent of Census was appointed. At all the censuses of South Australia, the work of collection was carried out by collectors acting under the direct control of the Superintendent, without the intervention of "enumerators" or similar officers. In tabulating the results of the censuses of 1851, 1855, and 1860 the Colony was divided into municipal corporations and wards, counties and hundreds, and districts comprising country outside of counties. From 1861 to 1901 the districts were so arranged as to admit of particulars being abstracted for each county, electoral district, hundred, district council, municipal corporation, and principal township; outer portions of the Province were divided into convenient areas comprising the chief pastoral districts not included in counties. The card system of tabulation was first adopted in 1901.
- 4. Scope of Inquiries.—At the censuses of 1844 and 1846 the inquiries were made as to name, sex, age, conjugal condition, religion, occupation and habitations. In 1851 inquiries as to nationality, length of residence in the Province, and sickness and infirmity were added, while the question as to religion was omitted. In 1855 the inquiries were the same as in 1851, with the addition of a question as to relationship to head of household. In 1861 an inquiry as to birth-place was substituted for that as to nationality, the inquiry as to religion was revived, and an inquiry as to education was added. The scope of the inquiry was not altered until 1881, when it was extended to comprise nationality, number of houses unoccupied and being built, number of rooms occupied, and education at school and university degrees. Since 1881 the census schedule has substantially retained its form, being slightly modified in 1891 and 1901 so as to come into line with those of the other States of the Commonwealth.
- 5. Remuneration of Collectors and Total Cost of Census.—At the more recent censuses up to that of 1901, the remuneration of collectors was at the rate of £1 per day, limited to the period estimated to be necessary for the collection; for the 1901 census the rate was 15 shillings per day for collectors in municipal corporations, and £1 per day in country districts.

The cost of the censuses of 1891 and 1901 is shewn in the following statement:-

South Australia.—Cost of Censuses, 1891 and 1901.

Particulars.	Collection.	Compilation. Printing, Stationery, etc.		Printing Tables.	Total.	
1891 1901	£ 7,597¹ 8,304¹	£ 4,519 5,981	\$ 811 1,062	£ 752 724	£ 13,679 16,071	

<sup>&</sup>lt;sup>1</sup> Two-fifths of this sum was debited to electoral expenses for collection of names on rolls.

### SECTION 6.—WESTERN AUSTRALIA.

- 1. Early Enumerations.—The Colony of Western Australia was first permanently settled in 1829, when Lieutenant-Governor Stirling, with a party of intended settlers and a detachment of marines, disembarked and encamped on the north bank of the Swan River, near the place known as Rous Head. Enumerations of the number of settlers in the infant Colony were made from time to time, usually annually; they were not, however, of an entirely trustworthy nature, and the information obtained thereby was very meagre, relating, as it did, up to 1840, only to the numbers of each sex in each district of the Colony. From 1840 to 1843 partial particulars as to age were obtained, the numbers of each sex under and over 12 years being recorded. These early enumerations ceased in 1843.
- 2. The First Census, 1848.—The first regular census of Western Australia was taken on the 10th October, 1848, under the superintendence of the Registrar-General. This census was taken under the provision of an ordinance (12 Vict., No. 4), which was passed in order "to make provision for ascertaining with accuracy the number of persons in the Colony of Western Australia, together with the amount of live-stock and crop and other statistical particulars." No mention is made in the report either of the method of enumeration or of the nature of the schedule on which the information was obtained. It is consequently impossible to say with certainty, whether the householder schedule method or the canvasser method was followed, though it would appear from a reference in the report on the second census to the "novel forms" and new mode of distribution and collection of individual returns" made use of thereat, that at the first census the latter of the above methods was employed.
- (i.) Scope of Inquiry. The objects of the inquiry at the census of 1848 were as follows:—
  (a) The number of colonists in each county, town, or village, distinguishing the sexes, ages, and social condition of the inhabitants. (b) The religion of each individual. (c) The occupation of individuals in 18 divisions, and (d) aboriginal natives actually employed by colonists, and an estimate of their numbers in the located districts.
- (ii.) Population Enumerated. The population enumerated, exclusive of aboriginals, was 4622. There were 541 aboriginals in private employ, and an estimated number of 1960 in located districts.
- 3. The Census of 1854.—The second census of Western Australia was taken on the 30th September, 1854. As no description is given in the report of the method of enumeration, and no sample of the schedule used is published therein, the nature of the particulars asked for cannot be precisely indicated. From an examination of the tables published it would appear that the scope of inquiry was identical with that in 1848. Coming, as this census did, within a few years of the conversion of the Colony into a Penal Settlement, a great deal of interest was centred in the question of the relative proportions of "free" and "bond," and six tables are devoted to an analysis of the male population into the classes of "Civilian," "Military," "Conditional Pardon," "Ticket-of-Leave," and "Imprisoned." The total population enumerated, exclusive of aboriginals, was 11,743.
- 4. Censuses of 1859 and 1870.—The third census of Western Australia was taken on the 31st December, 1859, and the fourth on the 31st March, 1870. For neither of these censuses are copies or descriptions of the schedules used now available, and the nature of the information obtained can only be ascertained by an examination of the published tables. The method of enumeration was similar to that now in force, involving the distribution and collection of schedules, on which the heads of the several households supplied the required information. The schedules were distributed and collected by the police, under the supervision of the several Resident Magistrates. In 1859 a distinct advance was made on the previous censuses, no less than three new heads of inquiry, viz., Habitations, Birthplace, and Education, being added, while the particulars tabulated with regard to ages and also with regard to occupations are much fuller than those previously published. In the tabulation of religions, the classification was extended. The scope of inquiry in 1870 covered almost exactly the same ground as the census of 1859, though in one or two instances the inquiries in 1870 appear to have been somewhat more detailed. The total number enumerated (exclusive of aboriginals), was 14,837 in 1859, and 24,785 in 1870.
- 5. Censuses of 1881 and 1891.—The fifth census was taken on the 3rd April, 1881, and is notable as being the first occasion of a simultaneous enumeration being made throughout Australasia, the date chosen being that selected by the Imperial authorities for the census of Great Britain and Ireland. The sixth census was taken on the 5th April, 1891, in accordance with the resolutions passed at the Hobart Conference of 1890, already mentioned. The census of 1881 was taken under an Act (44 Vict., No. 2) passed to perpetuate the provisions of the Ordinance referred to above (see para. 2 hereof). In spite, however, of this perpetuation, a new Act (54 Vict., No. 7) was passed, which repealed both the Acts previously mentioned, and under

which the censuses of 1891 and 1901 were taken. The census of 1891 appears to have been the first census of Western Australia at which the services of any persons outside the police force were enlisted for the distribution and collection of the schedules. The census of 1891 is notable as being the first census of Western Australia at which the card system of tabulation was used.

- (i.) Scope of Inquiry. At the census of 1881 the heads of inquiry were considerably extended, and were as follows:—(a) Name, (b) Relation to head of family, (c) Conjugal condition, (d) Sex, (e) Age, (f) Occupation, (g) State of health, (h) Year of arrival in Colony, (i) Birthplace, (j) Country where married, (k) Religion, (l) Education, (m) Class (free or bond), and (n) Description of dwelling; while agricultural, live-stock, and mining statistics were also collected. It will be noticed that in connection with the ordinary census matter two new heads, viz., State of Health and Year of Arrival in Colony, were added. In 1891 some of the heads of inquiry made use of at the previous census, viz., the inquiries as to "Country where Married," "Year of Arrival in Colony," and "Class (free or bond)" were omitted, while several new ones were introduced. The new subjects were in connection with Occupations and Sunday Schools. Persons following certain occupations were asked to state whether they were "manufacturers" or "dealers," and in the case of each occupation whether "employer," "wage earner" or "unemployed." It was also requested that in the event of any person being a Sunday School teacher or scholar the fact should be noted on the schedule. Particulars as to acreage of land under cultivation, and numbers of live-stock, were still obtained in 1891, but other agricultural and mining inquiries were dropped.
- (ii.) Enumerators' Divisions. At both these censuses the census districts were again identical with the districts of the Stipendiary Magistrates, each Magistrate directing the distribution and collection of schedules in his own district. In 1881 the number of Census Districts was 14, and in 1891 was 18. At the latter Census the number of sub-enumerators' districts was 129.
- (iii.) Population Enumerated. The population enumerated (exclusive of full-blooded aboriginals) was 29,708 in 1881, and 49,782 in 1891.
- 6. The Census of 1901.—This census was taken, under the Act of 1890 (54 Vict., No. 7) already referred to (see paragraph 5 hereof), on the 31st March, 1901, simultaneously with the censuses of the other Commonwealth States and of practically the whole of the British Empire.
- (i.) Divisions and Sub-divisions. The existing Magisterial Districts were adopted as Census Districts, and the Stipendiary Magistrates were appointed enumerators for their respective districts. The census districts were divided into sub-enumerators' districts by the respective enumerators in such a manner as to allow of the duties of distribution and collection of the schedules being performed by one sub-enumerator in each district within the allotted time.
- (ii.) Enumerators and Sub-enumerators. Where possible the services of the police were obtained to act as sub-enumerators; in other cases civilians were appointed. The total number of enumerators was 37, and of sub-enumerators 494. Gratuities to the enumerators ranged from a minimum of £5 to a maximum of £26 each, the total amount thus granted being £313. The maximum general rate of pay for sub-enumerators was 10 shillings a day for those on foot, and £1 a day if mounted; an extra half day at the foot rate was allowed for making up the returns. In special cases higher rates of pay were, however, paid to the sub-enumerators than those just specified.
- (iii.) Scope of Inquiry. The scope of the inquiry was in accordance with the resolutions passed at the Census Conference of 1900 (see p. 38 hereinbefore), the schedule being practically identical with those used at the 1901 censuses of the other States of the Commonwealth. Particulars as to areas of land held and cultivated, live-stock, and agriculture were not collected.
- (iv.) Population Enumerated and Cost of Census. The total population enumerated at the census of 1901 (exclusive of full-blooded aboriginals), was 184,124. The total cost of the census was £11,993, or 15.63 pence per head.

# SECTION 7.—TASMANIA.

1. Introduction.—Although official estimates of the population of Tasmania—or Van Diemen's Land, as it was then called—were prepared from time to time after the first settlement was established in the island on the 12th September, 1803, it was not until the 27th September, 1841, that the first proper census of the population was undertaken. The succeeding censuses, up to and including that of 1870, were taken fairly frequently, the average interval being only

about  $5\frac{1}{2}$  years; the later censuses—those of 1881, 1891, and 1901—were taken decennially. The following table shews the dates of the censuses and the authority under which each was taken.

Act.						Date Assented to	Date of Census.	
	Vict.,	No.	7	•••	 	30th June, 1841		27th September, 1841
7	,,	,,	5		 	15th November, 1843)	[	lst January, 1848 <sup>1</sup>
9	,,	,,	3		 	31st October, 1845		lst March, 1851 <sup>2</sup>
0	,,	,,	11		 	17th January, 1857		31st March, 1857 <sup>3</sup>
4	,,	•••	10		 	4th October, 1860		7th April, 18614
3	,,	,,	7		 	22nd October, 1869		7th February, 1870 <sup>5</sup>
4	••	,,	1		 	20th October, 1880		3rd April, 1881
5	,,	,,	2		 	11th July, 1891		5th April, 1891
4	,,	,,	3		 	24th August, 1900		31st March, 1901

Tasmania.—Dates of Censuses and Authority under which Taken.

- <sup>1</sup> Date fixed by proclamation 15th November, 1847. <sup>2</sup> By proclamation 22nd January, 1851. <sup>3</sup> By proclamation 16th February, 1857. <sup>4</sup> By proclamation 25th February, 1861. <sup>5</sup> By proclamation, 3rd January, 1870.
- 2. Early Censuses.—The earliest enumerations of the population were carried out by means of "musters," which were conducted on lines nearly similar to those in New South Wales.<sup>1</sup>

In 1803 the settlement of Risdon in Van Diemen's Land appeared for the first time on the New South Wales muster-sheets; but it was succeeded almost immediately by Sullivan Cove, which designation in turn quickly disappeared under the general title of Derwent River, and later still of Hobart Town.

- (i.) Census of 1841. In 1841 an Act was passed directing that an account of the population should be taken annually; for this purpose Commissioners were to be appointed, and the island was to be divided into convenient parishes. The subjects of inquiry at the first census were name, age, sex, civil and conjugal condition, habitations, religion, and occupation. An abstract of the census returns was published in the Hobart Town Gazette of the 20th May, 1842.
- (ii.) Census of 1848. In 1843 an Act was passed repealing the previous Act, and directing that a census should be taken triennially, commencing on the 1st January, 1846. In 1845, however, another Act was passed, repealing the provision for a triennial census and providing that thenceforward the dates of the census should be fixed by proclamation. Under this provision censuses were taken in 1848 and 1851. The subjects of inquiry at both these censuses were substantially the same as in 1841.
- (iii.) Census of 1857. In 1857 another Act was passed providing for a new division of the Colony into parishes for census purposes, and in February a proclamation was issued appointing the 31st March as the day for taking the next census. The heads of inquiry were not altered.
- (iv.) Censuses of 1861 and 1870. The Census Act of 1860 provided that a census should be taken on the same day as that appointed for a like purpose in the United Kingdom. The date of the census of 1870 was fixed by proclamation under an Act of 1869. At both the censuses the original subjects of inquiry were extended by the addition of questions as to (a) relationship to head of household, (b) birth-place, and (c) education, while the inquiry as to civil condition (bond or free) was omitted.
- 3. The Census of 1881.—This census was taken on the same date (3rd April) as that appointed for the census of the United Kingdom. Certain particulars as to which information was to be collected were specified in the Census Act, 1880, and the Governor in Council was empowered to prescribe the forms to be used and to make regulations for carrying out the Act. On this occasion "religion" was not included among the subjects of inquiry, but two new subjects were added—(a) Physical and mental condition, whether deaf-and-dumb, blind, lunatic, or idiot, and (b) Land in occupation. Additional information was also sought as to the attendance of children at school, and as to the number of children and young persons under 20 receiving instruction. The work of tabulation was carried out more elaborately than on previous occasions and was extended so as to comprise (a) electoral, (b) municipal and police, and (c) registration districts. The number of persons enumerated was 115,705, and the total cost of the census was £3015, or 6.23 pence per head. The rate of remuneration paid to collectors was 10 shillings per day while acting on foot, and 20 shillings per day on horseback.

 $<sup>^{1}</sup>$  See page 41 hereof, and see "General Report on Eleventh Census of New South Wales," pp. 24-6.

- 4. The Census of 1891.—This census was carried out in accordance with the plan agreed upon by the Conference of Australasian Statisticians held in Hobart in 1890 (see p. 37 hereinbefore). The scope of the schedule was enlarged by the addition of an inquiry as to grade of occupation—(a) employer of labour; (b) in business on one's own account; (c) relative, assisting head of family in his business, not receiving a nominal salary or wage; (d) wage earner; (e) unemployed during week preceding census day—while the inquiry as to religion was revived, the reply thereto being made optional. The information compiled under different categories and sub-divisions was considerably widened, and the card system (see p. 15) of tabulation was utilised. The number of persons enumerated was 146,667. Particulars are not available as to the total cost of this census; the cost of enumeration only was £1820, as compared with £1896 in 1881, and £1778 in 1870, the corresponding amounts per head of population being 2.98, 3.93, and 4.30 pence.
- 5. The Census of 1901.—The arrangements for this census, as well as the methods of enumeration and tabulation, were similar to those adopted in 1891, and were in accordance with the resolutions passed by the Census Conference held in Sydney in February and March, 1900 (see p. 38). An inquiry as to the length of residence in the Colony (if not born therein) was added to the schedule, while that as to sickness and infirmity was somewhat restricted. The actual work of enumeration was carried out by 390 sub-enumerators, the cost of such work being £1888. The population enumerated was 172,475, the total cost of the census being £3,767, or 5.24 pence per head of population.
- 6. Cost of Censuses, 1861 to 1901.—The following table shews, so far as particulars are available, the cost of the censuses of Tasmania since 1861.

Tasmania.—Cost	of	Censuses,	1861	to	1901.
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Particulars.	1861.	1870.	1881.	1891.	1901.
Collection	. £ 1,439	£ 1,778	£ 1,896	.£ 1,820	£ 1,888
Expenses	181	293	1,119	1	1,879
Total	. 1,620	2,071	3,015	1	3,767
Per Head	4.32d.	4.88d.	6.23d.	1	5.24d

<sup>&</sup>lt;sup>1</sup> Not available.

## CHAPTER V.

# THE CENSUS AND STATISTICS ACT, 1905.

#### SECTION 1.—INTRODUCTION.

- 1. General.—Commonwealth legislation dealing with census matters is confined to the Census and Statistics Act, 1905 (No. 15 of 1905), which was passed on the 8th December, 1905. This Act, as its name implies, deals not only with the census, but also with statistics generally; it is divided into five parts, of which the third relates specifically to the census. The text of the Act is given in full in Appendix 1 hereof. Provisional Census Regulations (Statutory Rules 1910, No. 96) were made under the Act on the 27th October, 1910; these Provisional Regulations were confirmed by Statutory Rule 1911, No. 4, and may under that Rule, be cited as the Census Regulations, 1911. These Regulations may be found in Appendix 2 hereof.
- 2. Administration.—On the 18th June, 1906, the first Statistician of the Commonwealth of Australia was appointed, and it is the duty of that officer to carry out the provisions of the Act, subject to the regulations and directions of the Minister for Home Affairs. Later in the same year the Commonwealth Bureau of Census and Statistics was organised, and the principal officers were selected and appointed. It is the function of the Commonwealth Statistician, under the Act of 1905, to take all necessary steps for the taking and collection of the census, and it is expressly stated in the Act that the Governor-General may enter into arrangements with the State Governments for the execution by State officers of any powers or duties conferred or imposed by the Act. Under the authority thus given, arrangements were made whereby responsible officers of the several States, acting under instructions from and under the immediate direction of the Commonwealth Statistician, were made supervisors of the collection of the census within their own States. The officers thus appointed were the State Statisticians of New South Wales, Victoria, Queensland, South Australia, and Tasmania, and the Chief State Electoral Officer of Western Australia.

# SECTION 2.—THE TAKING OF THE CENSUS.

- 1. Periodicity and Date of Census.—The Act provides (a) that "the census shall be taken in the year 1911, and in every tenth year thereafter," and (b) that "the census day shall be a day appointed for that purpose by proclamation." The date of the census was fixed to be the 3rd April, 1911, by proclamation issued on the 31st January, 1911, that date being selected in order to make the Commonwealth Census synchronous with the censuses of the United Kingdom and other parts of the British Empire.
- 2. The Householders' Schedule.—The duty of preparing and issuing forms and instructions and of making all necessary arrangements for the taking of the census is imposed by the Act upon the Statistician, subject to the regulations and directions of the Minister. In addition it is provided by Section 10 of the Act that "for the purpose of taking the census a form called the householder's schedule, shall be prepared and left, in accordance with the regulations, at every dwelling throughout the Commonwealth." Every occupier of a dwelling, with whom a householder's schedule has been left, is required to supply all the particulars specified therein, duly signing and delivering the schedule to the collector authorised to receive it.

In view of the adoption of a personal card for each person of a household it was thought desirable to make further provision for the filling in of the particulars on these cards by individual persons, as distinguished from the filling in of the householder's card by the householder. Accordingly it was prescribed by the Census Regulations (see Appendix 2, Regulation 12 (2)) that each person who abides in a dwelling-house on the night of census day must fill in the particulars required on the personal card so far as relates to himself or herself, or must supply to the occupier all information necessary to enable him to fill in such particulars.

By Section 21 of the Act it is, however, expressly provided that "no person shall be liable to any penalty for omitting or refusing to state the religious denomination or sect to which he belongs or adheres." This is the only query on the census schedule to which the option of refusing to furnish a reply is allowed; in every other case a refusal renders the person liable to a fine of £10.

It is the duty of each collector, if requested, to assist occupiers of dwelling houses in filling up the schedule, and to satisfy himself by inquiries from occupiers or other persons that the schedule has been correctly filled up. Every person must, to the best of his knowledge and belief, answer all such questions asked him by a collector as are necessary to obtain any information required in the schedule.

- 3. Particulars in Schedule.—The particulars to be included in the schedule are not strictly delimited by the Act, inasmuch as in addition to those particulars which are specifically mentioned, others may be prescribed by Regulation. The provisions of the Act in this respect thus allow of sufficient elasticity for such variations to be made from time to time in the schedule used at successive enumerations as the exigencies of the case may require. By Section 12 of the Act it is provided that the particulars to be specified in the schedule shall include the following:—
  - (a) The name, sex, age, condition as to, and duration of, marriage, relation to head of the household, profession or occupation, sickness or infirmity, religion, education, and birthplace, and (where the person was born abroad) length of residence in Australia and nationality of every person abiding in the dwelling during the night of the census day;
  - (b) The material of the dwelling and the number of rooms contained therein;
  - (c) Any other prescribed matters.

By the Census Regulations, 1911, (No. 8 (3) ) it is provided that the schedule shall, in addition, include the following:—

- (d) In relation to buildings—(i.) the nature of the building, (ii.) whether the occupier is the owner, tenant, or rent purchaser, (iii.) the amount of weekly rent payable or rental value per week.
- (e) In relation to persons—(i.) the race to which they belong, (ii.) the number of their children living or dead from any existing or previous marriage, (iii.) the date of their arrival in Australia.
- 4. Nature of Householder's Schedule.—The nature of the "form called the Householder's Schedule," referred to in the Act, is not specified therein, but is defined by the Census Regulations, 1911, No. 8 (see Appendix 2). It is thereby prescribed (a) that the householder's schedule shall consist of a householder's card, and a personal card for each person of the household, and (b) that the householder's card and personal card shall be in accordance with such forms as the Commonwealth Statistician thinks fit. A detailed consideration of the schedule may be found in Chapter VI. hereof.
- 5. Definition of a Dwelling.—The provisions of Section 10 of the Act to the effect that a schedule should be left at every dwelling throughout the Commonwealth, made it desirable that the meaning of the word "dwelling" should be defined in the Act. Accordingly in Section 3 it is stated that "dwelling" means "a building, erection, or tenement, whether permanent or temporary, which is wholly or partly used for the purpose of human habitation, and includes any ship or other vessel in any port of the Commonwealth, or in any inland waters thereof, or any ship or vessel registered in Australia on a passage between any two Commonwealth ports." Later in the Act, Section 10 (2), it is further provided that "where a dwelling is let, sub-let, or held in different apartments and occupied by different persons or families, each part so let, sub-let, or held and used for the purpose of human habitation, shall be deemed a dwelling-house."

Under the Commonwealth Act, therefore, a dwelling may be (i.) a complete dwelling house, (ii.) a flat, (iii.) apartments in a dwelling house, (iv.) an hotel, (v.) an institution, religious, educational, charitable, etc., (vi.) caretaker's quarters in a store, office, etc., (vii.) a tent, (viii.) a vessel in a Commonwealth port, (ix.) an Australian registered vessel on a passage between Commonwealth ports.

## SECTION 3.—MISCELLANEOUS.

- 1. Declaration of Secrecy.—Secrecy on the part of all officers engaged in the census is enjoined by a Declaration prescribed under Section 7 of the Census and Statistics Act. This Declaration is signed not only by those persons, such as enumerators and collectors, engaged in the actual taking of the census, but also by all officers (including compilers, draftsmen, clerks, etc.) engaged at the Central Bureau, either in the preparatory work or in the tabulation and analysis of the census returns. Under Section 24 of the Act, any officer who, after having made the prescribed regulation, divulges the contents of any schedule or card or any information furnished in pursuance of the Act, is punishable upon conviction by a penalty not exceeding £50.
- 2. **Penalties.**—The penal clauses of the Act and the Regulations made thereunder (see Appendices 1 and 2) provide for penalties, ranging from £5 to £50, in case of infringement of the various provisions of the Act. The penalty specified at the foot of any section, regulation, or paragraph indicates that any contravention of the section, regulation, or paragraph is punishable upon conviction by a penalty not exceeding the penalty mentioned.

## CHAPTER VI.

# THE CENSUS SCHEDULE.

#### SECTION 1.—INTRODUCTION.

- 1. General.—In this chapter it is proposed to discuss briefly the leading features of the schedule adopted for the first Commonwealth Census. To begin with, it should be observed that the scope of the census in most countries is at present seriously limited in various ways, among which the principal one is probably the difficulty of obtaining intelligent and accurate answers to census inquiries. If the questions asked are of a complicated nature, too great a strain will be put upon the intelligence or comprehension of the less educated class of citizens; if they are of such a character that they can be interpreted as an undue invasion of the privacy of the individual, for example as regards property, income, or social matters, even though the answers thereto would assist in the solution of economic and social problems of the greatest national importance, such questions will be met by some with passive resistance, by others with indignant opposition—or, by what may be worse, inaccurate replies. In practice, therefore, the census inquiries are advisedly worded in such a way that they cannot well be misunderstood even by the more ignorant members of the community, and are limited to such subjects as will not unnecessarily invade the privacy of the individual; they must also be in such a form that they will elicit the same sort of information from all persons.
- 2. The Nature of the Schedule.—In previous Australian Censuses the information has been asked for on a schedule in which the various queries appeared at the head of vertical columns, the particulars concerning each person being written on a horizontal line extending across the face of the schedule. Each schedule usually made provision for twenty persons. At the census now under review the nature of the "householder's schedule" referred to in the Census and Statistics Act 1905, was prescribed by Regulation (see Appendix 2) and consisted of a householder's card (see p. 64) and a personal card (see p. 65) for each person in the household. Supplementary to the schedule were an envelope (see p. 65) and a set of instructions (see Appendix 3) with each personal card. One householder's card was provided for every dwelling, and was filled in by the head of the household or the person in charge; a personal card was provided for each member of every household who was present on the night from the 2nd to 3rd April, 1911, or who, being absent on that night, returned next day, and was filled in either by the individual to whom the card referred, by the head of the household, or in some cases by the collector. The advantages of using a separate card for collecting the information from each person have already been referred to (see p. 13 herein-before), and it may here be remarked that the adoption of these cards at the first Commonwealth Census has been amply justified, without regard to other benefits, merely by the ease with which it has been possible to deal with the returns at the Central Bureau.

The progressive development of the Australian Census schedules has already been dealt with, and the subjects of inquiry included in the schedule used at the first Commonwealth Census have been compared with those comprised in the schedules used at previous censuses in Australia. (See p. 40 hereinbefore.)

3. Duties of Householder or Person in Charge.—General directions for the guidance of the householder or person in charge of the dwelling were furnished on the face of the envelope, a copy of which is reproduced on page 65 hereinafter, and in the first part of the Instructions. (See Appendix 3.)

The householder or person in charge of the dwelling was required to fill in the personal cards and the householder's card (forming together a householder's schedule) contained in the envelope, or was to see that each person who abode in the dwelling on the night of Sunday, 2nd April, 1911, himself or herself filled in one of the personal cards. The householder or person in charge of the dwelling was further required to furnish on personal cards particulars regarding those persons travelling or out at work during that night (and not included elsewhere), and who returned to the house or dwelling on Monday, 3rd April. If the house was occupied by different families on separate floors or in separate tenements, each such floor or tenement was required to be treated as a separate dwelling, and the occupier or person in charge of each had to make a return upon a separate householder's card. In the case of large pastoral and other similar establishments the proprietor or superintendent was allowed to fill in the returns of his complete

establishment, but a separate householder's card had in this case to be used for each of the outstation dwelling-houses or huts in which a distinct family or person resided, in addition to that for the home station; and if any out-station was in a different collector's district from that of the home station, the schedule (householder's and personal cards) for it had to be delivered to the collector of the district in which such dwelling was situated.

It was the collector's duty to verify the facts, and, if the cards from any cause should not have been filled in, or should have been erroneously or insufficiently filled in, to record the necessary particulars or make the necessary corrections, from enquiries which he was authorised to make for that purpose.

#### SECTION 2.—THE PERSONAL CARD.

1. General Features.—The particulars which were asked for on the personal card in regard to each individual are comprised under fourteen headings, and are of a simple and readily ascertainable nature. A reduced copy of the personal card is reproduced below. The cards used in all the States, and in the Northern Territory, were precisely similar, except that the names of the individual States (and of the Northern Territory) were respectively specified immediately above the heavy horizontal line at the head of the queries.

# Commonwealth of Australia.—Census, 3rd April, 1911.

Reduced Copy of Personal Card.

Consus Form 3. CONFIDENTIAL.  Before filling in this Card please study the Directions on the accompanying	SPECIM
Sheet and the Specimen Card on the Back hereof.	<b>/ A</b> ₀ co
A. COMMONWEALTH OF AUSTRALIA.	CENSU
CENSUS, 3rd APRIL, 1911.	/ OZMO
PERSONAL CARD	For Every Person
For every Person present in the Night from 2nd to 3rd April, 1911, or returning on 3rd April (if not included elsewhere).	or returning
Personal Card No; of Householder's Schedule No;	Personal Card
of Mesh No, of Collector's District; of Census District No	of Mesh No. 3; of
This column is to be left blank.	l. Name in full—
1. Name in full (Underline Surname).	(Underline Surnau
(Underline Suranes). *  2. Sex { Write M for Male }  Write F for Female }	2. Sez-{ Write M Write F
3. Date of Birth:—Day———————————————————————————————————	8. Date of Birth:-
(a) If exact date of birth is unknown, state age at last birthday—years.	(a) Where exact d
(If married, write M. )	If married, write
If widowed, write W. If divarced, write D.	If widowed, writ
(If never married, write N. M.)	(If never married
b. Date of existing Marriage :- Year	5. Date of existing
6. Number of Children (living and dead) from existing Marriage	6. Number of Childr
(a) Number of Children (living and dead) from previous Marriage	(s) Number of Chi
7. Relation to Head of Household	7. Relation to Head
8. State if Blind or Deaf and Dumb	8. State if Blind or
9. Country or Australian State where Born [If a British Subject by Parentage, write P.]	9. Country (or Aust (If a British Subj
0. If a British Subject by Naturalization, write N.	10. If a British Subj
Race:	11. If born outside
1. If born outside Commonwealth, state length of residence therein-	Q years.
(a) Date of Arrival) :- Day ; Month ; Year	() Date of Arrive
2. Religion	12. Religion— Presi
3. Education	13. Education— R. U
(a) At present receiving Education	(a) At present re
4. Profession of Occupation.	14. Profession or Occ
(a) State if Employer or Employee, Sec	(a) State if Empl
(6) If out of work, state period.	(3) If out of work
(c) Occupation of Employer (if any).	(c) Occupation of

EN OF A FILLED IN PERSONAL CARD. MMONWEALTH OF AUSTRALIA. S, 3rd APRIL, 1911. PERSONAL CARD present in the Night from 2nd to 3rd April, 1911, on 3rd April (if not included elsewhere). No. 3; of Householder's Schedule No. 27; Collector's District 13; of Census District No. 8. State of- Victoria. Hiller, James. for Male | Jik Day, 9: Month, Sept., Year, 1890. ate of birth is unknown, age at last birthday n.u. of Household— South Parallan State) where Born— Scotland, ect by Parentage, write P. ect by Naturalization, write N. 9. Commonwealth, state length of residence therein-1)-Day, 13; Month, March; Year, 1902. yterian Ch. of Australia. B. Se. Helbourne. ceiving Education— U. - Student at University. Employer (if any).

FACE OF CARD.

BACK OF CARD.

A copy of the instructions, issued with each personal card, will be found in Appendix 3 hereof.

The column on the right of the card was left blank so as to allow space for filling in at the Census Office for tabulation purposes certain numbers or symbols representing the particulars furnished for the individual referred to. This matter is dealt with further in Chapter VIII. (see p. 82) hereinafter. It may be observed that the upper right hand corner of each card was clipped at the place indicated in the sample above; this was done for the sake of convenience in counting the cards and in sorting them into packs or bundles during the process of tabulation. The actual size of the card was 8 in. by 5 in.

- 2. Particulars to be Filled in by Collector.—The particulars specified above the heavy line on the card had to be filled in by the collector. These particulars were provided as a key to the place (i.e., the electoral division, district, or province, or municipal district, etc.) to which each individual should be allocated, and were necessary so that the population of the various districts and divisions of the Commonwealth and its component States and territories, electoral and municipal districts, eity wards, suburbs, etc., might be accurately ascertained.
- 3. Particulars to be Filled in by Individuals.—Having indicated the locality, the next thing required was to obtain an account of the individual; this was accomplished by means of the queries specified below the heavy line.
- (i.) Name. The first query was provided for the insertion of the full name of the individual, and hence the census is what is known as a "nominal" census, as distinguished from one in which the names are not given, but merely the number of persons arranged under certain specified heads. As before pointed out (see p. 20), the early censuses of England were of this latter nature, but the many recognised advantages attaching to a nominal census have now led to its almost universal adoption. In the first place, it is necessary to legally connect the person to whom the information applies with the information furnished, in order to ensure just returns being made. Secondly, the nominal census is much easier for those required to make the returns; and thirdly, owing to the information being given separately for each person of either sex, the number of possible combinations of the various particulars for tabulation purposes is increased, and the practical scope of the census is thus usefully extended.

So far as the actual tabulating and compiling work performed at the central Census Bureau is concerned, particulars as to name are of no importance, except as an indication of sex, since the census results are, of course, absolutely impersonal, and refer to aggregates only. These particulars serve, however, as a useful check both in collecting and compiling, and the objects of the query may be said to be (a) to facilitate further inquiry by the collector if it is found that any of the later queries have been erroneously or insufficiently answered, (b) to enable the number of each sex specified in the householder's card to be verified, and (c) if necessary, to provide a check on the accuracy of the information asked for in the query relating to sex.

- (ii.) Sex. The statement of the sex of each person was provided for in the second item of inquiry, in reply to which the letter "M" was required to be inserted if the person was a male, and "F" if a female. This query was necessary since names do not invariably furnish a reliable indication of the sex.
- (iii.) Date of Birth. In this query provision was made for ascertaining the age of the person to whom the card referred. Many persons seem to think that it is a matter of comparatively little importance what age they fill in on the census schedule, so long as it is somewhere near the mark. In past censuses of Australia, as well as of other countries, the returns in regard to age have been grossly inaccurate, large numbers concentrating at the ages ending in 0 and 5, the concentration being most marked at ages ending in 0. This practice is much to be deplored, since many of the uses to which the census results are put require that the ages should be, as nearly as possible, correct; hence inaccurate returns render the results much less valuable than if the true ages were given. The present form of inquiry is new to Australian Censuses, and was adopted because it was thought that most people, when they wish to state their ages, refer back to the date of birth. It was, however, pointed out on the card that where the exact date of birth was unknown, the age at last birthday should be given, a special line being provided on the card for this purpose. The results of the present census (1911) exhibit much less in the way of inconsistent age deviations than has been the case in previous censuses. (See Chapter X., Ages, hereinafter).
- (iv.) Conjugal Condition. Query 4 related to the condition as to marriage, and was not required to be answered in the case of children under twelve years of age. Provision was made for denoting to which of the four divisions—married, widowed, divorced, or never married—the individual belonged, the letters "M," "W," "D," or "N.M." being used to indicate the respective conditions. Many interesting and important questions, social and economic, depend for their elucidation upon the information furnished in reply to this query.
- (v.) Date of Existing Marriage. The immediate object of this inquiry was to obtain particulars as to duration of marriage of persons at various ages, for tabulation in conjunction with sizes of families, in investigating the question of fertility.
- (vi.) Number of Children. This inquiry, to be answered by married, widowed, or divorced persons, related to the number of children (living and dead) born to the person to whom the card referred. Separate queries were made in respect of children from an existing and from a previous marriage. The main object of this and the preceding inquiry was to throw some light upon what are generally regarded as some of the most pressing problems of the day, viz., the causes of the decline in the birthrate, the postponement of marriage to a later age than formerly, the average number of children per family, and the fertility or reproductive powers of married couples in relation to their ages at the time of marriage, and in relation to their birthplaces and religions. Such problems as these are of immense importance from the standpoint of our national destiny. If a nation is content to drift along the path of least resistance, it

must necessarily suffer from a one-sided or defective development. It will be evident, further, that in this country where we have the British race transplanted and new influences at work, it is desirable to watch with adequate attention the evolution of the people, and to systematically study the development of the race. Schemes for the guidance of national growth, and for the welface of the constituent elements of an infant nation, cannot hope to be uniformly successful unless directed by an adequate study of the development of population in every material relationship.

- (vii.) Relation to Head of Household. Query 7 provided for the statement of the relation which the particular individual referred to bore to the head of the household—that is, whether wife, son, daughter, or other relative, visitor, lodger, or servant, and in the case of public institutions whether officer, patient, nurse, prisoner, etc. Although it is not ordinarily tabulated, the information here furnished is of value for checking purposes, and is, in the case of dependents, used in connection with the tabulation of occupations.
- (viii.) Blindness and Deaf-mutism. Provision was made for the statement of cases of blindness or deaf-mutism. It was pointed out in the instructions that only persons totally unable to see should be entered as blind, and as deaf and dumb only those who were deaf as well as dumb.

This query differs somewhat from the corresponding one in the schedules of the 1901 Australian Censuses, owing to the omission of certain inquiries relative to each person who at the time of the census was "laid up or unable to follow his or her usual occupation by reason of illness or accident." A return of sickness, taken for a specified date, while furnishing interesting and valuable information for the time being, cannot be regarded as one likely to furnish reliable data on which an estimate could be based of the amount of sickness experienced throughout the year, since the accuracy of any such estimate must necessarily depend on whether the date chosen for the enumeration is one at which the amount of sickness is normal. It would only be by making several such inquiries in the course of the year, or by the adoption of compulsory notification for all important cases of sickness coming directly under medical observation—that thoroughly reliable and therefore useful information of this nature could be obtained.¹ In the case of accidents, the effect of the season would not be so marked as it would be in that of sickness, but the mere record of persons incapacitated by accident through various causes at any particular point of time would be of little value as a guide to the total accidents occurring during a specified period. Blindness and deaf-mutism being permanent infirmities, statistics relating thereto are, of course, not subject to seasonal fluctuations.

- (ix.) Birthplace. In answer to this query, only the name of the Country, Colony, or State of the Commonwealth was required to be specified, since the entry of some insignificant town or district as "country where born" often entails a considerable waste of time in inquiry and investigation by the census clerks.
- (x.) Nationality and Race. In connection with this and the preceding query, it may be noted that three distinct matters are frequently confused, viz., country of birth, race, and nationality (i.e., political allegiance). No attempt was made on the card to ascertain any particulars concerning nationality, except such as were required in order to enable a distinction to be made between those persons who were British subjects and those who were subjects of foreign powers. A person may be a British subject by reason, either of place of birth (which would be disclosed in query 9), by parentage or by naturalization (query 10). In query 10, in case where a person was a British subject by parentage, the letter "P" was required to be inserted, and where by naturalization, the letter "N." The inquiry as to race was not required to be answered by persons of European race; in all other cases the proper information, such as Aboriginal, Chinese, Japanese, Hindu, Javanese, Manilaman, Negro, Polynesian, or Aboriginal half-caste, Chinese half-caste, etc., as the case may be, was to be inserted. In view of the requirements of the Commonwealth Representation Act, of the expressed determination of the people of the Commonwealth to preserve their country as a "white Australia," and of other questions relating to the number of aliens—especially of the Chinese and Japanese in the Commonwealth—it was considered of importance that this information should be carefully collected.
- (xi.) Length of Residence in Commonwealth. This query provides for a statement of the number of years each individual, not born in the Commonwealth, had resided therein. As a check on the number of years stated, the date of arrival in the Commonwealth was also asked.

As an indication of the permanence of settlement of the Commonwealth, this information is of considerable value, as also in connection with the conditions of residence imposed under the Commonwealth old-age and invalidity pensions system. As shewing the difficulty which has been experienced in drafting unambiguous questions, so that they cannot well be misunderstood, it may be mentioned that at the 1901 census of Western Australia, in one case the reply received to the query "Length of residence. If not born in Western Australia, state length of residence therein," was, "36-ft. half-block"; while in several cases the "length of residence" was stated to be 6 by 8, evidently referring to a tent of those dimensions.



- (xii.) Religion. Religious denomination was the subject of inquiry in query 12, and it was asked that the denomination or sect to which each person belongs should be explicitly stated. Vague, indefinite terms, which might mean one of several different religious bodies, were to be avoided. If any person, however, conscientiously objected to state his religious denomination, the word "object" could be inserted, this being the only query on the census card to which the option of refusing to furnish a reply was allowed. In every other case, a refusal rendered the person liable to a fine of £10. In the case of children, however young, the religion in which it was intended they should be brought up was required to be inserted.
- (xiii.) Education. Query 13 provided for particulars relating to education. In the first line, provision was made for the degree of education to be stated, the information required being, however, of a very simple nature. If a person could not read, the letters "C.R." were to be inserted; if able to read English but not to write it, the letter "R," was to be inserted; and if able to read and write English, the letters "R.W." If not able to read English, but able to read though not to write, a foreign language, the letters "R.F." were to be inserted; and if not able to read and write English, but able to both read and write a foreign language, the letters "R.W.F." If the person to whom the card related had obtained a University degree, the degree was to be stated, as well as the name of the University and the country in which the degree was obtained. Query 13 (a) referred only to persons receiving instruction at the time of the census. In this line, the kind of school, etc., was to be indicated. For this purpose "U." denoted a university, "S." a State school, and "P." any other school; while "H." was to be inserted if instruction was being received at home. The name of the school, etc., was to be added.
- (xiv.) Profession or Occupation. Query 14, the last on the personal card, related to profession or occupation; and, detailed directions as to filling in the answers thereto were given in the Instructions distributed with the cards (see Appendix 3). It was considered of the greatest importance to ascertain accurately the proportion of the population which obtained a living in each of the many avenues of employment, and the instructions were intended to ensure that the occupations should be stated with sufficient clearness to admit of their being grouped under well-defined heads, and classified according to the nature of the object for which the work was performed. Thus, for example, the term "labourer" is such a very broad one, and embraces so many and such varied occupations, differing essentially both in nature and object, that it is absolutely necessary that some distinguishing words or phrase should be used in order that the person enumerated might be counted in that class to which he rightly belongs. Similar remarks apply to such designations as clerk, carter, book-keeper, salesman, etc. These all required to be duly qualified, as, for example, clerk to grocer, brewer's carter, drapery salesman, etc., in order that the employment provided by each class of occupation might be accurately ascertained. In order to give still greater precision to the nature of the occupation, a subsidiary query 14 (c) was added, specifying the occupation of the individual's employer, if any.

The system of classification which has been adopted in the compilation of the present census, provides for the division of occupations into eight main classes:—(i.) Professional (ii.) Domestic. (iii.) Commercial. (iv.) Transport and communication. (v.) Industrial. (vi.) Agricultural, pastoral, mineral, and other primary producers. (vii.) Independent; and (viii.) Dependents. These classes are divided into 27 orders, which are further divided into 111 sub-orders, and these in turn into 654 groups of occupations. The occupation to be specified was that which each person was following and deriving support from at the date of the census. If any person was unemployed at that date, the occupation usually followed was to be inserted. If out of work for a period exceeding one week immediately prior to the date of the census, the period should be specified in reply to query 14 (b). The object of this query is to afford some further indication as to the economic condition of different industries, and the state of the labour market, employment, etc.

Query 14 (a) provided for a statement of the grade, etc., of the occupation, letters being used for the purpose of distinguishing. Thus "E." inserted in this line, denoted an employer of other labour than that of household servants; "O." a person in business on his own account, but not employing others; "A." a person assisting the head of the household in his business, but not receiving salary or wages; "W." a person receiving salary or wages; "N." a person who, at the date of the census, was out of work, and had been so for more than a week prior to that date. The information furnished in reply to this query supplies the means for obtaining an interesting indication of the magnitude of the various branches of industry in the community, as well as furnishing a basis for the investigation and establishment of schemes for social insurance.

## SECTION 3.—THE HOUSEHOLDER'S CARD.

- 1. General.—The principal objects in view in providing householder's cards in addition to the personal cards relating to each member of the household, were :—
  - (a) To enable a preliminary count merely of the numbers of each sex to be obtained as soon as possible after the date of the census.
  - (b) To act as a check on the number of personal cards in each household.
  - (c) To obtain information as to dwellings.

A reduced copy of the householder's card is reproduced below.

The householder's card was of the same size (8 in. by 5 in.) and shape as the personal card, and was the same for each of the States and the Northern Territory except that the name of each particular State or Territory was specified in its proper place.

#### Commonwealth of Australia, Census, 3rd April, 1911.

Reduced Copy of Householder's Card.

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FACE OF CARD.

BACK OF CARD

Directions for filling in the householder's card were given on the envelope (see p. 65 hereinafter), and the Instructions (see Appendix 3). These were required to be carefully read before a start was made at filling in the face of the card.

- 2. Particulars to be Filled in by Collector.—As in the personal card, so in the householder's card, the first lines—down to, and including particulars of street, and number or name of dwelling—were to be filled in by the collector, and were embodied on the card for the purpose of fixing the localities to which the persons enumerated belonged. Particulars as to locality were specified on the householder's card in greater detail than in the personal card, since each of the latter could be identified (as regards locality) by means of the corresponding householder's card.
- 3. Particulars to be Filled in by Householder or Person in Charge.—The five queries grouped together under bracket relate to dwellings, and were required to be filled in by the householder or person in charge. These particulars are of great importance both from an economic, social, and hygienic point of view, as throwing light on the subject of the housing of the people.
- (i.) Nature of Building. Query 1 relates to nature of building, and particulars were to be inserted specifying whether the dwelling was a private house, a tenement in a private house, an hotel, a boarding or lodging house, a religious or educational institution, a military establishment, a charitable institution, a penal establishment, or other class of dwelling.
- (ii.) Materials. In query 2 provision was made for inserting particulars as to the material of which the outer walls of the dwelling were composed. Each householder was required to state whether these consisted of stone, brick, concrete, wood, iron, canvas, or whatever material may have been used.
- (iii.) Number of Rooms. In reply to the third query the number of rooms was to be stated. The kitchen was to be included as one of the rooms, but such a room as a shop, office, store, bathroom, pantry, or outhouse was to be excluded, unless some one slept therein. In case of a tenement the number of rooms in the tenement only was to be given.

- (iv.) Owner, Tenant, or Rent Purchaser. Query 4 provided for a statement as to whether the householder was the owner, tenant, or rent purchaser of the dwelling. The information was to be given by inserting the letter "O." if an owner, "T." if a tenant, and "R.P." if a rent purchaser.
- (v.) Rent or Rental Value. In reply to the fifth query particulars were to be given as to the weekly rent payable or rental value per week. Tenants were required to specify the actual rent per week; owners, rent purchasers, and others not paying rent had to state the rental value per week.
- (vi.) Tabular Statement of Persons in Household. In the tabular statement the name of each individual, for whom personal cards were filled in, was to be specified. The name of the head of the household was inserted first, followed, when necessary, by those of the wife, children, other relatives, visitors, lodgers, and servants in their respective order. It was pointed out that it was desirable that the full Christian name or names should be given in all cases where space permitted, as often providing a useful check on the accuracy of the information supplied in the personal cards, but where it was found impossible to insert full Christian names, initials were accepted.

The householder's card, after being carefully filled in, had to be signed by the householder or person in charge of the dwelling to which it referred.

(vii.) Houses Uninhabited or being built. A separate householder's card was to be filled in by the collector relative to each house intended for a residence which was uninhabited or in course of erection at the date of the census; giving, so far as possible, all the particulars required. The word "uninhabited" or "being built," as the case might be, was to be written across the card. It appears, however, that in many cases the collectors did not fully carry out their instructions in respect to this matter, and that returns of the houses uninhabited or being built are therefore defective.

#### SECTION 4.—THE ENVELOPE.

1. **General.**—Each householder's card, with its corresponding personal cards, was placed by the collector, before delivery to the householder or person in charge, in a special envelope. The particulars printed on the face of the envelopes are shewn below; the back of the envelopes was left blank. Their actual size was  $8\frac{1}{2}$  in. by  $5\frac{1}{2}$  in., or somewhat larger than the size of the cards themselves.

Commonwealth of Australia, Census, 3rd April, 1911

Reduced Copy of Face of Envelope used to hold Householder's and Personal Cards.

COMMO		05 444	CONFID			A DD TT	1011
COMM	NWEALIR	UP AU	STRALIA.	CENS	us, sra	APRIL,	TATT.
ENVEL	OPE No	of Mesh No.	; of Collector's [	istrict	of Census Di	strict No.	<del>,</del>
		ST	ATE OF				
Ð.			TO THE HOUS	EHOLDER,			
Blank Forms	This Envelope contains—	Filled-in Forms returned to Collector.	Mr. (Mrs. Miss)_		<del></del>		
	Personal Cards A Householders' Cards B				•		
				TRUCTIONS			

- 2. Object of Envelopes.—The primary object of providing the envelopes was, of course, to minimise the risk of loss of individual cards and to keep each householder's card in contiguity with its corresponding personal cards. It was considered necessary that the cards should be so kept together for the following reasons, viz., (a) For the convenience of the collector in keeping a record of the number of cards delivered to, and collected from, each householder, and in order to enable the collector to readily ascertain that the number and sexes of the persons specified on the personal cards for each household corresponded with the particulars given on the tabular statement on the householder's card. (b) To enable a further check to be made at the Central Census Bureau to ensure that the particulars of numbers of each sex specified on the householder's card corresponded with the number and sex of the persons for whom personal cards were furnished. (c) To enable the tabulation of certain particulars—such, for example, as the relative ages, birthplaces and religions of husbands and wives, and the sizes of families in relation to ages of parents to be readily effected.
- 3. Particulars to be Inserted.—All the particulars on the envelope, with the exception of that relating to the number of filled-in forms returned to the collector, had to be filled in by the collector before delivering the schedule. The particulars as to forms returned were required to be filled in by the collector when collecting the schedule.

# CHAPTER VII.

# PRELIMINARY WORK OF THE CENSUS.

#### SECTION 1.—INTRODUCTION.

- 1. General.—As the census of the 3rd April, 1911, was the first census taken for the whole Commonwealth under the Federal Constitution, it is thought desirable to place on record in this Report not only the procedure followed and the preparations made previous to the actual taking of the census, but also to note some of the principal experiences then gained. Such a record will probably prove of general interest, and will also be of material assistance to those officers who are entrusted with the organisation of the arrangements for the next Commonwealth Census. Further, it is hoped that these matters will be of technical interest and value to persons, not only in the Commonwealth, but also in other parts of the world, who are concerned in the operation of census-taking, a matter of interest in all civilised countries.
- 2. Nature of Preliminary Work and Method of Organisation.—Probably only those who have closely studied or have been engaged in carrying out a census realize the enormous amount of preparatory work entailed, the extent of the field of inquiry, and the amount of detail to be covered for the purpose of getting accurate returns. In the first place the nature and extent of the questions to be submitted had to be carefully considered from various points of view, and possible objections to certain queries or methods of presenting them had to be investigated before even the form of the census schedule could be drafted. Then the whole country had to be divided up into census districts and collectors' districts, in the most advantageous manner possible under the existing circumstances, care being taken that the collectors' districts were not too large, so that the collector was able to distribute and collect all the schedules within the allotted time. This subdivision in the first place entailed the preparation of maps on a large scale covering the whole country, shewing as clearly as possible the boundaries of the most important divisions, such as counties, electoral districts, municipalities, etc., and then these maps had to be divided into appropriate census districts. For each such district an officer—called an "Enumerator" -had to be selected, possessing such qualifications as would warrant his appointment in charge of the collection for that census district. For the purposes of organisation at the present census, the census districts were grouped together for each of the States of the Commonwealth, the census arrangements for each State being placed in charge of a supervisor, subject to the general control of the Commonwealth Statistician. The total number of enumerators employed at the census was 346. On each enumerator devolved the duty of cutting up his census district into suitable collectors' districts, and of selecting for each a person capable of carrying out the actual work of collection in that collector's district. The number of collectors engaged at the recent census was 6952; for each collector a map of his sub-district had to be provided. collecting in populous centres carried out their work on foot, while in the more remote districts bicycles, horses, motors, other vehicles, boats, and, in some cases, camels were required.
- 3. Visit of Commonwealth Statistician to Europe.—After the organisation of the Commonwealth Bureau of Census and Statistics, the initial steps towards making arrangements for the census were taken by the Commonwealth Statistician during a visit to Europe extending from April to December, 1909. The primary object of the Statistician's tour was to make inquiries as to the organisation and equipment of the more important Census and Statistical Bureaux in Europe, and to acquire information as to recent developments in the evolution of scientific methods regarding census and statistics. It may here be observed that the most striking feature of modern statistics is the development which is taking place along scientific lines. The wide reach of statistical method, and the demands it makes in regard to the necessary technical knowledge and mathematical equipment, in a word, its general scope and outlook, mark it out as among the wider fields of human knowledge. Mere tabulations of figures are only the foundation of statistics, not its superstructure, nor can mere compilers of, and commentators on, statistical tables be regarded as statisticians; probably much of the almost meaningless tabulation which in the past has passed current for statistics will in the near future be dispensed with, while penetrating investigations on scientific bases will take their place. This will, of course, in no way prevent analyses of returns being presented in popular form for the general reader.

In the course of his tour, the Commonwealth Statistician visited the Census and Statistical Bureaux at Rome, Florence, Vienna, Budapest, Munich, Stuttgart, Paris, Berne, Lucerne, Zurich, Berlin, Hamburg, Copenhagen, The Hague, and London, and acquired valuable information from the officers of these Bureaux. Arrangements were made, after consultation between the Commonwealth Statistician and the Registrar-General of England, for identity of dates and methods to be followed at the censuses of England and the Commonwealth.

Special inquiries were also made by the Statistician in regard to machinery employed for facilitating statistical and census work, and the following apparatus were examined, viz., (a) The Hollerith machine and the card-punching machine used in connection therewith; (b) The Austrian modification of the Hollerith Census Machines; (c) The Census Machines being constructed for the Statistical Department in Switzerland; (d) The "Classicompteur Imprimeur" used in the Statistical Bureau for France; (e) The Sorting Machine of the British Tabulating Machine Company; (f) The new machinery in course of preparation for the Director of the United States Census. The Statistician also acquired information regarding the new machine then being constructed for use in the Census of Japan, and inquired into the feasibility of attaching "counters" to sorting machines, so that they would sort and count at the one operation.

As a result of these inquiries it was decided, as previously stated (see p. 15 hereinbefore), that it was not desirable to use either tabulating or sorting machines at the first Commonwealth Census.

## SECTION 2.—THE CENSUS BUREAU AND THE STATE SUPERVISORS.

- 1. General.—Towards the end of December, 1909, a preliminary scheme was prepared by the Commonwealth Statistician for the organisation and conduct of the work involved in carrying the census to a successful issue, and in February, 1910, after various proposals and matters of special concern had been carefully considered, a modified scheme covering the main features of the work was drafted and received the approval of the Minister for Home Affairs. The first matter of importance, towards the execution of the scheme, was the selection of an officer in each State to act as the Commonwealth Statistician's deputy, and it was considered judicious, in the common interests of both Commonwealth and States, to secure the services, in the capacity of State Supervisor, of each State Statistician, or, failing him, of one of the State officers who had had experience in the organisation and conduct of any recent Australian Census.
- 2. Appointment of State Supervisors.—On the 2nd March, 1910, communications were addressed by the Commonwealth Government to the State Premiers, asking if it would be agreeable to their several Governments, that their Statisticians should act in the way suggested, subject to the following conditions, viz.:—
  - (a) That each State Supervisor should sign a declaration of fidelity under Section 7 of the Census and Statistics Act.
  - (b) That all communications with such officers acting under the Census and Statistics Act should be direct.
  - (c) That the State Supervisors should attend at the Commonwealth Bureau of Census and Statistics, Melbourne, to receive personal instructions from the Commonwealth Statistician; and
  - (d) That each Supervisor should be paid a fee of £105 on the conclusion of his duties. (This fee was afterwards increased to £157 10s.)

By the middle of April, 1910, letters were received from the Premiers of each of the States, except Western Australia, agreeing to the appointment of the State Statisticians as Supervisors, under the conditions suggested. The Statistician of Western Australia was unable to undertake the duties of State Supervisor of Census owing to pressure of official business and for private reasons, and arrangements were eventually completed on the 29th June, 1910, whereby the duties of Supervisor were undertaken by the Chief Electoral Officer of Western Australia, an officer who not only had taken a responsible part in the 1901 Census of Western Australia, but who also possessed a wide general knowledge of census and statistical matters, and whose experience in electoral organisation rendered his services particularly valuable. The appointments of the State Statisticians of New South Wales, Victoria, Queensland, South Australia, and Tasmania, were not actually confirmed until the 31st October, 1910, and were notified in the Commonwealth Gazette of the 5th November, 1910. The Gazette notices of the arrangements made (for all the States except Western Australia) were identical, and the forms thereof are shewn in Appendix 4. The appointment of the Chief Electoral Officer of Western Australia as Supervisor of Census for that State was not confirmed until the 24th November, 1910, and was notified in the Commonwealth Gazette of the 26th November following. stated in each of the Gazette notices that the arrangements made were deemed to have taken effect on and from the 1st July, 1910; the State Supervisors, however, took up their duties at an early date after the assent of their respective Governments to the suggested conditions had been obtained.

The names of the officers appointed to act as State Supervisors of Census in the several States are as follows:—

## Commonwealth of Australia.—Census, 3rd April, 1911.—State Supervisors of Census.

 New South Wales
 J. B. Trivett, F.S.S., F.R.A.S.

 Victoria
 A. M. Laughton, F.I.A., F.F.A.

 Queensland
 Thornhill Weedon, F.S.S.

 South Australia
 L. H. Sholl, I.S.O., J.P.

 Western Australia
 E. G. Stenberg, F.S.S.

 Tasmania
 R. M. Johnson, I.S.O., F.S.S.

- 3. Meeting of Commonwealth Statistician and State Supervisors.—In the meantime, in anticipation of the formal appointment as State Supervisors of the Government Statisticians of the five States which had already assented to the proposed arrangement, the Commonwealth Statistician was authorised on the 11th May, 1910, to at once ask each of these State Statisticians to attend at Melbourne. Towards the end of the same month a meeting was accordingly held and the preliminary scheme formulated by the Commonwealth Statistician was communicated, and the functions and duties of the State Supervisors were set forth. The nature and form of the census schedule, the scope of the inquiries to be included therein (having special regard to the requirements of the Census and Statistics Act), and the division of the States into census and collectors' districts were matters which received special attention.
- 4. The Scope of the Inquiry and Other Preliminary Investigations.—Whilst the arrangements for the appointment of the State Supervisors were being made, a number of matters were under consideration at the Census Bureau; of these there were two of special importance, viz., (i.) the nature, form, and scope of the householder's schedule, and (ii.) the preparation and examination of maps to shew the division of each State into suitable census districts.
- (i.) The Householder's Schedule. The nature and most suitable form of schedule having been decided,1 the question as to subjects of inquiry to be included required careful consideration. The census being an occasion on which the whole of the community is brought under review and on which it may be said that every individual is personally interviewed, a very natural feeling exists that such an opportunity should be utilised to the utmost, and that the list of inquiries should be very extensive. From the point of view of those responsible for carrying the project to a successful issue this general impression is extremely unfortunate, since it leads to requests for the making of many inquiries which lack the qualities necessary to warrant their inclusion in a census form, and prevents those advancing such requests from recognising the reasonableness of the reply that any such inquiry would overweight the schedule. Such persons usually find a difficulty in seeing how the addition of one question on a subject which appears to them of paramount importance could possibly have so disastrous an effect. What is usually overlooked is that if a concession is made in their case it will become increasingly difficult to refuse a similar concession to others who have, perhaps, equally strong claims to consideration. It may be laid down as a general principle that no inquiry is worthy to be included on the census schedule unless if has for its object the eliciting of some fact of wide general interest, information concerning which is of importance for administrative, economic, or sociological purposes.

Among the various matters with regard to which suggestions were received for inclusion as subjects of inquiry the following may be mentioned, viz., (a) Rate of wages or salary. (b) Days lost from work. (c) Contributions to income by wife and children. (d) Rent. (e) Bathroom. (f) Size of yard. (g) Whether a landowner or Crown lessee. (h) Whether the person desires to settle on the land; and (i) Use of alcoholic liquors as a beverage. Various suggestions were also received as to tabulation and presentation of results, and for enabling certain items of information to be supplied in such a manner that neither the head of the household nor the collector should be aware of their character.

It was eventually proposed to include in the census schedule (by Regulation under Section 12 of the Census and Statistics Act), in addition to the queries ultimately adopted, inquiries as to the following matters, and in the following form, viz.,—

- (a) Salary or Wages. State here the amount of your salary or wages at present time per day £....s...d., or per week £....s..d., or per month £....s...d., and amount earned during year ended 31st December, 1910 £....s...d.
- (b) Average Number of Hours' Work per day.....or per week.....
- (c) Notes and Coin in Circulation. State here the amount of money held by you, for example, on your person, in your business tills, in safe deposit, but not in any Bank or similar institution:—Notes, £.....s.; sovereigns and half-sovereigns, £....s.; silver, £.....d.; copper, £.....d.

<sup>&</sup>lt;sup>1</sup> The special advantages of the householder's and personal cards as compared with the old form of schedule have already been referred to (see p. 13).

(d) Total Abstinence. If you are a total abstainer from alcoholic beverages, write "Yes"; if you are not, write "No".............

It was considered desirable that these queries should appear at the end of the personal card, and be so arranged that the part of the card containing them could be folded and sealed, in order that the replies thereto would not be open to inspection by the collectors. It was also proposed to include among the confidential inquiries necessary references to divorce.

Draft Regulations for the inclusion of the queries specified above, together with copies of the cards proposed, were in due course submitted for the consideration of the Commonwealth Legislature, in the course of which it was decided by the Senate that the four queries specified above should be disallowed. The form of cards and the subjects of inquiry approved of by Parliament were as shewn on pages 60 and 64 hereinbefore, the confidential inquiries being discarded and the inquiry as to divorced persons being transferred to query 4 of the personal card.

It may incidentally be remarked that the form of the card as finally approved by Parliament was substantially identical with that originally submitted, and the range of questions was unaltered.

- (ii.) Other Elements of Preparatory Work. The scheme of collection having been formulated, the scope of the inquiry defined, and the State Supervisors appointed, the other main elements of the preparatory work of the census requiring attention consisted of:—
  - (a) Issue of instructions to Supervisors.
  - (b) Appointment of draftsmen and provision of accommodation for same.
  - (c) Preparation of enumerators' maps for each State.
  - (d) Appointment of enumerators.
  - (e) Drafting and printing of forms and instructions for enumerators.
  - (f) Division of enumerators' (census) districts into collectors' sub-districts. Selection of collectors.
  - (g) Preparation of collectors' maps.
  - (h) Appointment of collectors.
  - (i) Drafting and printing of forms and instructions for collectors.
  - (i) Supply of material to collectors.
  - (k) Explanation of duties to collectors.
  - (l) Advertisement of census and issue of pamphlets etc., thereon.
  - (m) Provision for special collections in trains, in ships, etc.
  - (n) Appointment of interpreters.
  - (o) Preparation of scheme of tabulation.
  - (p) Co-ordination of material collected at past censuses.
  - (q) Examination and appointment of tabulating staff.
  - (r) Provision of accommodation for tabulation staff.
  - (s) The writing of the Census Report, preliminary Chapters.
  - (t) Preparation for analysis of results and technical and scientific investigations.
- 5. General Instructions to State Supervisors.—The next matter of importance requiring attention was the preparation and issue of a set of instructions for the guidance of the State Supervisors. In these instructions (which were issued on the 30th June, 1910, and of which a copy is given in extenso in Appendix 5 hereof) the Supervisors were notified of their appointment and were furnished with a copy of the Census and Statistics Act, 1905. They were informed that their appointments would date from the 1st July, 1910, and would terminate on the 30th June, 1911, and they were invited to make any desired queries, comments, or suggestions as to the collection of the census, and to forward the same to the Commonwealth Statistician.

As soon as possible after these instructions were issued, large-sized maps, which, with the exception of those for Tasmania, had been prepared at the Census Bureau, were forwarded to each supervisor, shewing the partition of his State into census (enumerators') districts.

In the case of Tasmania all maps for census purposes were prepared by the Surveyor-General's Department of that State, under the guidance of the State Supervisor.

- (i.) Emolument of Enumerators. The State Supervisors in due course submitted to the Commonwealth Statistician statements on forms specially provided for that purpose, specifying what would be a fair rate of emolument for the person undertaking the duties of enumerator in each census district. The supervisors were instructed that the basis of such emolument was to be a guaranteed fee of at least £10 10s., together with such further payment, dependent on the amount of work involved, having regard to the area and probable population of each district.
- (ii.) Selection and Appointment of Enumerators. On receipt of the Statistician's approval of the suggested rates of emolument, the supervisors were directed to select for each census district a duly qualified person willing to undertake the duties of enumerator at the rate specified. Where obtainable, the following persons were suggested as being suitable for appointment:—
  (a) Resident or police magistrates. (b) Town clerks. (c) Shire secretaries. (d) Clerks of Courts. (e) Mining Registrars. (f) Electoral Returning Officers. (g) Persons who had

satisfactorily performed similar duties on a previous occasion. Where such persons were not available, the supervisors were instructed to obtain suitable persons by inquiry or advertisement. On completion of the list of enumerators, the supervisor forwarded the same to the Commonwealth Statistician for approval, on the forms which had been used for transmitting suggested rates of emolument. These forms were submitted by the Statistician to the Minister for Home Affairs for final approval. The supervisors, on receipt of such approval, formally notified the persons approved of their appointment, at the same time obtaining from each a declaration of secrecy and fidelity, and a service undertaking signed in duplicate. The appointments of enumerators were subsequently notified in the Commonwealth Gazette.

- (iii.) Enumerators' Maps and Sub-divisions. When the appointment of each enumerator had been notified, a list of instructions was forwarded to him direct from the Census Bureau, together with a map of his division on a large scale, for subdivision into collectors' districts. These districts were to be of such a size that the work of distributing and collecting the census forms therein could be readily carried out in a limited time to be prescribed by the enumerator and approved by the Commonwealth Statistician. On the completion of the work of subdivision each enumerator forwarded his map to his supervisor, together with a rough description of the boundaries proposed and a distinguishing letter for each proposed collector's district. After having satisfied himself that the districts proposed were suitable, and in accordance with the instructions issued to the enumerator, the supervisor forwarded the maps and descriptions to the Commonwealth Statistician. After approving each subdivisional scheme submitted, a set of maps shewing collectors' districts was prepared at the Census Bureau. A list of these was forwarded for the information and guidance of the supervisor, and a map of his census district, shewing the boundaries of the collectors' districts comprised therein, was forwarded to each enumerator, while a set of maps, each dealing with one collector's district, was forwarded for the use of the collectors themselves. A general map was also forwarded for the guidance of the supervisor.
- (iv.) Selection and Appointment of Collectors. As early as possible after the approval of his scheme of subdivision, each enumerator nominated for each collector's district comprised in his division a person considered suitable to act as collector; and on completing his list of collectors submitted the same to his supervisor for revision, after which it was transmitted to the Commonwealth Statistician. On being informed that the list was considered satisfactory, the supervisor transmitted to the enumerator the necessary forms of service "undertaking" between the enumerator and collector, together with the letter of authority to act as collector. Each collector was required to make a declaration of fidelity and secrecy; these declarations, and also, on the satisfactory completion of service, the undertakings made by the collectors, were transmitted by the enumerators to the supervisor, by whom they were eventually forwarded to the Commonwealth Statistician.
- (v.) Instructions to Enumerators and Collectors. The supervisors were directed to make themselves familiar with the instructions issued to enumerators and collectors, so as to be in a position to promptly advise these officers on any points which might arise in the performance of their respective duties. In case of doubt reference was to be made to the Statistician, if time permitted; if not, the supervisors were to act on their own responsibility.
- (vi.) Final Revision of Census Arrangements. The supervisors were requested to assure themselves during the month of March, 1911, that all preparations for the census had been duly made, and that all enumerators and collectors were ready to carry out the work of collection expeditiously. Special care was to be taken that no islands had been omitted from the scheme of collection.
- (vii.) Other Matters. The Supervisor's Instructions also contained directions as to various other matters, viz.:—emergency appointment of enumerators and collectors, census posters, preliminary count, transmission of forms, enumerators' vouchers, postal and telegraphic arrangements, printing, and general census provisions; the most important of these matters are further dealt with in their proper order in the succeeding parts of this Report.
- 6. Instructions to Record Clerks Assisting State Supervisors.—It had been arranged that each State Supervisor should be furnished with the services of a record clerk and a typist, and on the 30th June, 1910, instructions were issued from the Census Bureau to these record clerks (see Appendix 6). After drawing attention to the fact that the records of the State Supervisors were to be forwarded to the Census Bureau, when the work of census collection was completed, and to the necessity for uniformity in keeping these records in the several States, the system to be adopted was outlined, and directions were given for the preparation, numbering, and indexing of appropriate files, for the keeping of précis sheets, and for the registration of correspondence inwards and outwards. Instructions were also given as to postage books, stamps, and stationery.
- 7. Financial Instructions to State Supervisors.—Financial instructions were issued in September, 1910; a copy of these instructions may be found in Appendix 7, and it may be seen that the first part thereof related specifically to State Supervisors. For the purposes of providing to each supervisor a sub-advance to be operated upon for paying incidental and petty

cash expenditure, an account, designated "Commonwealth Census Account," was opened in each of the State capitals. Provision was made for travelling expenses, cost of conveyance, and postage stamps, and the supervisors were informed that the authority of the Minister for Home Affairs, through the Commonwealth Statistician, was to be obtained for expenditure, such as printing, clerical assistance, etc., prior to any liability being incurred; in cases of extreme urgency the supervisors could, however, incur the expenditure in anticipation of Ministerial approval. Persons engaged for clerical assistance were to be selected from the register of applicants in the office of the Public Service Inspector, and orders for services other than those paid for by petty cash were to be issued by the Commonwealth Statistician.

#### SECTION 3.—THE ENUMERATORS, AND THEIR DUTIES.

- 1. General.—In a previous part of this Chapter the method of selection and appointment of enumerators has been outlined, and their preliminary duties have been indicated (see p. 70 hereinbefore). On the 30th September, 1910, instructions were issued by the Statistician to the enumerators; these instructions (a copy of which may be found in Appendix 8) were divided into four parts, viz.:—(i.) Preliminary; (ii.) Definition of Collector's Districts; (iii.) Selection and Appointment of Collectors; and (iv.) Final Instructions; and it will be convenient to refer briefly to their main requirements under each of these four heads.
- 2. Preliminary Matters.—The attention of the enumerators was first drawn to the fact that the collection of the census data was to be effected on cards, instead of on schedules as on former occasions, and the nature of the "householders' schedule "adopted under the Census and Statistics Act 1905, and consisting of a householders' card and personal cards with the supplementary instructions and envelope, was described. Notice was to be given later to each enumerator of the number of police constables (if any) which would be available for the work of collection in his district.
- 3. Definition of Collectors' Districts.—The boundaries of each census district were shewn in broad red-coloured lines on the plan forwarded by the Commonwealth Statistician to the enumerator. The boundaries of the Commonwealth Electorate Divisions were marked in green, those of the State Electorate Divisions in blue, those of the State Electoral Provinces in broken blue lines, those of Counties in yellow, those of Municipalities or other Local Government areas in neutral tint, and those of Municipal Sub-divisions (Wards or Ridings) in broken lines of neutral tint.
- (i.) Method of Subdivision into Collectors' Districts. The first duty of each enumerator, after having made a careful study of the map of his district, was to suggest a scheme for the division of the whole of his district into collectors' districts. In regard to all municipalities and towns, and also to other populous centres, the census district had to be so divided as to admit of all schedules being distributed during the four days preceding Sunday, 2nd April, and collected during the eight working days following on that date. In the scattered country districts more time was to be allowed, but the sub-divisions were to be such that all the returns, even in the most remote part, might be collected by the 24th April, at the very latest. Each enumerator was directed to carefully consider, and to enter in a prescribed form, the number of days which, in his opinion, should be allowed each collector for the distribution and collection of the schedules; except under special circumstances, payment to collectors was to be allowed only for the number of days thus allotted. The boundaries marked on the enumerators' maps—including those of counties, parishes or hundreds, Commonwealth electoral divisions, State electoral districts and provinces, municipalities, and in certain cases, municipal wards—were to be taken into account in fixing the boundaries of the collectors' districts. Wherever practicable, the boundary of a collector's district was not to cross any of the boundaries thus shewn.
- (ii.) Lettering of Collectors' Districts and Numbering of Meshes. Each census district was numbered, and a distinguishing letter was given to each collector's district therein; the letters for each such district were duly recorded in the prescribed schedules supplied to the enumerators. The lettering of the collectors' districts in each census district ran from A onwards.

In cases where the boundary of a collector's district was crossed by the boundary or boundaries of any electoral, municipal, or other divisions, the areas (within each of such collectors' districts) formed by the intersection of the boundaries of the electoral, municipal, or other divisions, either with each other, or with the boundary of the collector's district itself, were termed "meshes," and were distinguished by consecutive numbers, commencing at unity, suffixed to the particular letter indicating the collector's district in question. The population living within each "mesh" had to be accurately ascertained. The object of this arrangement was to enable the population of any electoral, municipal, or other division to be determined by allocating thereto the number of persons within the particular "meshes" comprised in such division.

<sup>&</sup>lt;sup>1</sup> In Western Australia statistical districts were also shewn.

- (iii.) Density of Population. In apportioning collectors' districts the enumerators were directed to consider the distance to be traversed by the collectors in going from dwelling to dwelling. It was pointed out in the instructions that in a town where the houses adjoin or are only a few yards apart, from 150 to 200 inhabited houses might be included in each collector's district, whilst in suburban districts and villages or townships where the dwellings are moderately contiguous, although further apart than in a closely-built town, the number might be from 100 to 150; in the more settled agricultural districts where there is occasionally a distance of more than half-a-mile between one dwelling and the one nearest to it, the number might be from 50 to 100; and in the more scattered districts where intervals of 2 miles or upwards may intervene between the dwellings, less than 50 might be included in a collector's district. Due consideration had also to be given to the collector's method of travelling, i.e., whether on foot, bicycle, horse, or otherwise.
- (iv.) Definition of Boundaries. The enumerators were instructed that the boundaries of the collectors' districts were to be well defined and clearly described and that, where possible, well marked, natural or artificial boundaries such as rivers, creeks, roads, railways, telegraph lines, etc., should be adopted. In cases where streets, roads, or rivers were used as boundaries, the boundary-line was invariably to be understood to run in the middle of the street, road, or river, so that the houses on one side would be in one collector's district, and those on the other side in another collector's district adjoining. Wherever possible each municipality or ward, if not too large, was constituted a collector's district.
- (v.) Approval of Scheme of Subdivision. The enumerators were directed to cause the boundaries of, and the letter given to, each collector's district (and the number of each mesh) to be marked in pencil on the maps already forwarded, and also to give a description of the boundary lines of such districts on the prescribed schedules, which have already been referred to (see p. 72 hereinbefore) in connexion with the number of days to be allowed for the distribution and collection of the schedules, and which had to be made out in duplicate. The enumerators also had to specify in these schedules, in the columns provided for such purposes, the estimated number of dwellings, and the number of householder's schedules, and personal cards required in each collector's district, and had to state in each case whether it was proposed that the collector should act on foot, bicycle, horseback, or otherwise. The maps, with one copy of the schedule, were transmitted to the State Supervisor, by whom they were in due course despatched to the Commonwealth Statistician for final approval.

Immediately upon the receipt in the Census Bureau of these maps and schedules, the enumerators' suggestions were taken into consideration and, when finally approved, maps were at once prepared in duplicate on the largest scale available, shewing the boundaries of each census districts, and its component collector's districts and meshes, and a separate map of each collector's district was prepared for the use of the collector.

- (vi.) Other Matters. The enumerators were directed to make special arrangements (a) for providing the necessary collectors' districts for the shipping in port, fishing fleets, pearling fleets, etc., and (b) for the enumeration of the inhabitants of the islands off the coast. Arrangements for the collection of particulars relative to persons travelling on the railways were made by the State Supervisors.
- 4. Selection and Appointment of Collectors.—When the enumerator's schedule and maps shewing the proposed division into collectors' districts had been examined, a transcript of the schedule, containing such alterations or additions as were thought desirable, was returned to the enumerator, together with maps shewing the approved boundaries of the collectors' districts and sectional maps of each such district for the use of the collectors.
- (i.) Selection of Collectors. The enumerators were instructed to proceed, on the receipt of these maps, with the selection of persons qualified to act as collectors. To those enumerators in whose districts the services of police officers to act as collectors were available, a list, containing the names, addresses, etc., of such officers, was forwarded.
  - (a) Police Collectors. It may here be remarked that in May, 1910, a communication was addressed by the Commonwealth Government to the Premiers of each of the States asking the State Governments to co-operate in the work by making available the services of the police for the distribution and collection of the schedules, on the conditions that the Commonwealth should recoup the States all out-of-pocket expenses actually incurred in rendering the service and that a bonus of 2s. a day for foot police, and 1s. a day for mounted police be paid to the individual members of the police force engaged in the work. It was not proposed to utilise the services of the police in the closely settled parts, but only in the outlying districts. The Governments of South Australia, Western Australia, and Tasmania granted the services of their police to the extent required, but in the other States the proposal was not accepted; in New South Wales, however, arrangements were ultimately made for the employment of police officers as collectors in a few districts where the enumerators stated it was impossible to obtain civilian collectors. The services of the police were also obtained in all the States in the days immediately following the census in obtaining particulars of travellers, tramps, campers, etc., who might have been overlooked by the regular collectors. In cases where police officers were available as collectors, the enumerators

were instructed to place themselves in communication with the officers commanding the police in the particular districts in question, and to obtain their views and suggestions as to the allocation of collector's districts to the police officers available.

- (b) Civilian Collectors. The most suitable collectors' districts having been decided upon and duly allotted to police collectors in the census districts in which they were available, the services of civilians had to be obtained for the remaining districts. The enumerator was, therefore, reminded that a collector, to enable him to fulfil his duties satisfactorily, must be a person of intelligence and activity, must neither be too young nor yet too old, must read and write well, and must be sufficiently healthy and strong to undergo the exertion of performing his task with promptness; that he must be of temperate habits and sufficiently good address to convey all the requisite information concerning the census in a manner calculated to command the good-will and co-operation of all concerned. It was further necessary that he should be thoroughly acquainted with the collector's district in which he was required to act, and he should, therefore, by preference, all other qualifications being equal, be selected from among those applicants who had resided in the district for some time, and whose business had brought them into frequent and direct personal contact with its inhabitants. It was further pointed out that it was desirable that each collector should live in or near his own collector's district, so that he should not have the additional labour of going far from his home before he could commence his duties. This rule was not, of course, to be rigidly adhered to, but had to be left to the discretion of the enumerator, who had to bear in mind that character and fitness were qualities to be considered of paramount importance. The enumerator was, in addition, directed to obtain the services of interpreters to accompany the collectors in any districts where large numbers of Asiatics or other persons unable to speak English existed.
- (ii.) Rates of Remuneration of Collectors and Time Allowed. With regard to the remuneration to be offered, it was arranged, except where otherwise specially authorised, to pay collectors acting on foot at the rate of 10s. per diem, collectors acting on bicycles at 15s. per diem, and on horseback at 20s. per diem; bicycles, horses, vehicles, petrol, and fodder were to be provided by the collectors. Should it be impossible, however, to obtain suitable collectors in some of the more remote districts at the above rates, and be found absolutely necessary to offer higher rates to secure eligible men, it was the enumerator's duty to submit in full his reason for so doing; this also applied in cases where it was necessary for a collector to hire camel or boat, or where any exceptional circumstances occurred.

No payment was to be allowed to the collectors for any time occupied in receiving instructions or in giving up returns after the census was over, but an additional sum of 5s. was to be allowed to each collector for the work of completing and summarising the entries in the collector's compilation book. Before submitting the name of any person for appointment as collector, the enumerator had to ascertain whether such person would agree to perform the work of distribution and collection of the schedules within the number of days already suggested by the enumerator in the schedule referred to (see p. 72); and the time thus agreed upon was specified in each case in the notification of appointment forwarded later by the enumerator to the collector. If the collector could not complete the collection in his district within the time specified he was bound by his instructions (to which he had undertaken to adhere) to continue until he had completed his work for the sum indicated in his appointment.

(iii.) Appointment of Collectors. As soon as the enumerator had obtained suitable applicants for the duties of collector in each of the sub-districts, he despatched to the State Supervisor a schedule stating the name, age, occupation, postal address, and suggested rate of pay per diem, if in excess of fixed rate, of each candidate, and the distinguishing letter of the sub-district proposed to be allotted to him. This schedule was forwarded by the Supervisor after revision to the Commonwealth Statistician, and after due consideration had been given to the circumstances of each case and any alterations made which were considered necessary, the schedule was approved and a transcript thereof returned to the supervisor, who in turn transmitted the same to the enumerator, together with the necessary forms of (i.) notification of appointment of collectors, (ii.) undertakings by collectors, and letters of authority to act as collector. In the transcribed schedule were embodied, in addition to the particulars referred to in the enumerator's schedule, the details of an estimate, which he had previously been required to furnish (see p. 73 hereinbefore), as to the number of dwellings in each collector's district, the number of householder's and personal cards required, and the number of days which he calculated should be allowed for the distribution and collection of the schedules in each collector's district. The letter of appointment was not to be delivered to the collector until he had made a declaration of fidelity and secrecy and signed an undertaking, the form of which had been previously submitted to, and obtained the approval of, the Commonwealth Law Officers.

The essential points of this undertaking under which the collector accepted the appointment were as follows:—(a) That he would faithfully perform the duties of census collector.

(b) That he would carry out, in every particular, the instructions of the Statistician or his State Supervisor, or the enumerator of his census district. (c) That he would not desert from his duty, nor refuse nor neglect, without just excuse, to perform his duties.

It was further pointed out in the notification of appointment (a) that the collector must preserve all cards, forms, and other documents and articles committed to his charge, and that he must, at the close of his work, render to the supervisor an account of the same; (b) that his appointment was terminable at the will of the Commonwealth Statistician; (c) that he was required to complete his duties within the time specified, and (d) that he would be paid therefor the sum indicated.

- 5. Final Instructions.—It was specially impressed upon the enumerators, that, while the preceding instructions were being complied with, they were to make themselves thoroughly conversant with all the details connected with the actual taking of the census, as set forth in the Census and Statistics Act, and in the several sets of instructions issued by the Statistician for the guidance of enumerators and collectors, and also in the instructions issued with the householder's schedule, etc. They were further directed to be particularly careful that all preliminary work was completed as long beforehand as possible, so that nothing remained unsettled or undecided on census day. In case of any doubt arising as to their own or their collectors' duties, or as to the various forms and instruction supplied to them, they were to at once apply to the State Supervisor. Enumerators of adjoining census districts were to be consulted when doubt existed as to the exact position of boundary lines common to both districts, and every precaution was to be taken to avoid the omission of any portion of the area allotted to them.
- (i.) Explanation to Collectors. The enumerator, after having made himself familiar with the collector's duties, was, wherever practicable, to personally explain them to each of his collectors and to go over his map with him, carefully pointing out and explaining the boundaries of the district; he was not only to fully explain the details of the householder's schedule and the manner in which the enumeration was to be performed, so as to secure uniformity of action, but was also to take an opportunity of ascertaining whether the instructions to collectors were properly understood by each. Where the district allotted to any collector was intersected by a boundary of any electoral or municipal division, etc., special care was to be taken to impress upon the collector the necessity for carefully ascertaining the position of any such boundary, and for correctly inserting the name of such division in the cards delivered by him in each particular "mesh" in his district.
- (ii.) Supply of Materials to Collectors. Forms and all other necessary articles were to be supplied by the enumerator to each collector in the quantities required, and in ample time to enable him to leave a householder's schedule at each dwelling within his sub-district within the appointed time. The enumerator was directed to obtain a receipt from the collector on a duplicate schedule for all cards and other articles supplied. After the work of collection was completed the enumerator obtained from each collector an account of the disposal of the cards and other things, and took over from him any balance remaining.
- (iii.) Marking and Numbering of Cards and Envelopes. The enumerator was requested to cause every envelope and every householder's and personal card, before being handed over to the collector, to be stamped with the number of the census district. The letter distinguishing the collector's district, the "mesh" number, and other particulars specified in a later part of this Chapter (see Section 4, par. 3), were to be filled in by the collector.
- (iv.) Enumerations of Persons on Board Vessels. In addition to obtaining schedules for all vessels in port in the Commonwealth on census night, the enumerators were instructed to make arrangements for collecting the requisite census information regarding all persons on board any vessel, other than a warship, which on census night was on a voyage from any port within the Commonwealth and of which the first port of call after sunrise on Monday, 3rd April, was in the Commonwealth. In case of vessels which arrived after sunrise on that day from any port outside the Commonwealth, schedules were not required. The master of each vessel leaving any Australian port for any other port in the Commonwealth during the week preceding Sunday, 2nd April, was to be supplied with schedules, so that returns could be furnished without delay at the next port of call. The collection on board warships in port was arranged by the State Supervisor.
- (v.) Miscellaneous. The enumerator was enjoined to duly impress upon the collector, before the latter actually commenced his work, (a) that having once accepted office he was not at liberty under Section 22 of the Census and Statistics Act to refuse the position or neglect the due performance of his duties, under a penalty of £20, (b) that he was not entitled to payment until he had faithfully performed his duties, (c) that no payment in excess of 5s. would be allowed for the time taken up in making up compilation books and schedules after the census was over, and (d) that under Section 24 of the said Act the householder's schedule and all other census forms were confidential documents, and that any officer divulging the contents of any such form was liable to a penalty of £50.

Should an enumerator for any cause deem it advisable to recommend the dismissal of a collector, he was empowered to temporarily appoint a substitute, but was directed to at once forward his report and recommendation for the consideration and approval of his supervisor.

In case an enumerator was prevented by sudden illness or other unavoidable cause from carrying out his duties, he was to report the fact at once by telegram to the supervisor, and if there were not sufficient time to enable the supervisor to appoint a successor, the enumerator was directed to depute at once some person to act for him; the appointment of that person as enumerator was to be subject to the subsequent approval of the supervisor.

6. Financial Instructions to Enumerators.—Financial instructions to enumerators were issued on the same form as that on which similar instructions were given to the State Supervisors (see Appendix 7). As regards travelling expenses, each enumerator travelling under authority from a State Supervisor was allowed 12s. per diem, except when travelling by steamer or other vessel in which the fare paid includes subsistence, in which case the allowance was 3s. per diem. In travelling by rail, road, or sea, the actual fare was allowed in addition to the above travelling expenses. Each enumerator was furnished by his supervisor with a supply of postage stamps, and was directed to keep a separate "stamp account."

Collectors were directed to forward all correspondence with the enumerator or supervisor in envelopes supplied for that purpose; postage stamps were not required for these, since the postage was to be paid by the enumerator or supervisor on receipt. Telegrams sent by a collector to his enumerator or supervisor were to be marked "Collect" on production to the telegraph officer of the letter of authorisation as evidence of his appointment.

#### SECTION 4.—INSTRUCTIONS TO COLLECTORS.

1. General.—It was found necessary to commence at an early date the preparation of the instructions to be issued for the guidance of the collectors; and since it was upon these men that the responsibility for the actual taking of the census depended, it was of importance that their instructions should contain minute and explicit directions as to the proper fulfilment of their duties. It may readily be understood that the efficiency of a collector largely depends upon his ability to grasp the idea as to how he is expected to carry out his duties, and that the drafting of a set of instructions equally suitable and intelligible to all is, therefore, a work of peculiar importance and difficulty. Whilst it is necessary that these instructions should be lucid, explicit, and easily understood, it is equally essential that they should be as concise as is compatible with completeness and intelligibility. Considerable care was therefore bestowed upon the instructions at the time of drafting them, while they were subsequently revised with minute attention; from knowledge since acquired it would appear that these instructions generally served their purpose admirably, though it is manifest that in a few cases no proper attempt can have been made to master their contents.<sup>1</sup>

A copy of "Instructions to Collectors" will be found in Appendix 9 hereof.

- 2. Scheme of Collection.—As soon as was practicable after his appointment, each collector was required to make himself thoroughly acquainted with the instructions to collectors and with the instructions accompanying the householder's schedules; he was also furnished with a copy of the Census and Statistics Act (see Appendix 1), and was directed to thoroughly master those Sections (principally Sections 8 to 15), which particularly pertained to him, and in addition he was to make himself acquainted with the manner in which the entries were to be made by the householder and others. In case the directions given were not absolutely clear, or in case of any doubt as to the exact position of the boundaries of his district, as shewn on the plan furnished to him, he was to confer with his enumerator. The attention of the collectors was specially drawn to the fact that the collection of the data was to be effected on cards, instead of on schedules, as on former occasions, and the precise nature of the "householder's schedule," with its supplementary "instructions" and "envelope," was pointed out.
- 3. Marking and Numbering of Envelopes and Cards.—The divisions shewn on the plan of each collector's district comprised portions of counties, parishes or hundreds, Commonwealth electoral divisions, State electoral districts and provinces, local government areas, and wards or ridings. As previously explained (see p. 72 hereinbefore), each enumerator's district was distinguished by a number, and each collector's district therein by a letter; and where a collector's district consisted of portions of two or more of any of the divisions referred to, such as portions of two or more counties, or portions of two or more electoral divisions, etc., the different "meshes" into which the district was thus divided were distinguished by numbers, commencing at unity, suffixed to the letter indicating the particular collector's district.

On each collector's map was affixed an explanatory note shewing the nature of the division indicated by each of the boundaries marked on the plan. The scale of the map and the bearings were also indicated.

<sup>&</sup>lt;sup>1</sup> In some cases the collectors in distributing the schedules did not include a personal card for the householder himself; in other cases a set of instructions for guidance in filling in the cards (see Appendix 3) was provided only for each householder's card, and not for each personal card, as directed. These defects were afterwards made good.

In addition to the above explanatory note each collector's plan was accompanied by a schedule in tabular form, on which the following particulars were specified for each "mesh" within the district, viz.:—County, Federal Electoral Division, State Electoral Province, State Electoral District, and Local Government Area, while columns were also provided for "Additional" and "Remarks." The collector was thus provided with a key to his plan, and he was able to ascertain at a glance the particular county, electoral division, etc., in which any "mesh" was situated.

With this explanation it may now be stated that one of the first duties of the collector, after having made himself thoroughly acquainted with his instructions, and the nature of his duties, was to fill in the requisite particulars as to locality on all householder's cards prior to delivery, the name of the State having already been printed, and the number of the census district stamped on these cards before they were issued to him. On reference to the form of householder's card given on p. 64 hereof, and to the information in regard thereto, it may be seen that the collector had to write on each householder's card prior to delivery, the following particulars, viz., number of householder's card, mesh number, distinguishing letter of collector's district, county, parish or hundred, federal electoral division, State electoral province and district, municipality or shire, ward or riding, town, etc. It was by means of the plan of his district, together with the explanatory note and schedule of "meshes," that the collector was enabled to fill in these requisite particulars without difficulty. As explained hereinafter, the blank spaces at the head of personal cards and envelopes, with the exception of those referring to the number of cards contained in the envelope, were to be filled in by the collector when delivering the schedules.

#### SECTION 5.—OTHER PREPARATORY WORK.

- 1. General.—While the work mentioned in the preceding parts of this Chapter was systematically proceeding, arrangements had to be made for commencing the tabulation and analyses of the material so soon as it reached the Census Bureau, so that as little delay as possible might occur after the actual enumeration had been completed; and in this connexion the results of previous Australian Censuses had to be collected and co-ordinated so far as possible, so that they could be compared directly with the results of the present census of the whole Commonwealth, and the tendency of the community in the direction of gain or loss could be thereby determined. This necessarily involved the study of past census reports, both local and of various other countries, as well as of much current literature bearing on the subject; for the methods of presentation of the facts had to be carefully weighed and considered as to whether and how far they were suited to present requirements, as altered or necessitated by recent progress.
- 2. Arrangements for Tabulation.—So soon as the most desirable system for the presentation of the census results had been decided upon, and the methods of tabulation and analysis of results had been adopted, the forms necessary for these purposes had to be carefully drafted and printed, while arrangements had to be made for the selection and accommodation of the special census staff to carry out the work of tabulating the data.

The preparation of this Report and of the preliminary work for the special investigations included herein had also to be considered. It may here be observed that it would appear that a comprehensive  $aper \epsilon u$  of the history and methods of census-taking throughout the civilised world has not hitherto been published. As a considerable amount of special research and study was undertaken to carry out the census in the light of what has previously been undertaken, it seemed desirable to place on record in the preliminary Chapters of this Report such information in regard to census-taking as the study referred to revealed.

- 3. Advertising the Census.—Although, in accordance with the provisions of the Census and Statistics Act, the date for the taking of the census had been duly appointed by the Governor-General in Council, and a Proclamation to that effect published on the 31st January, 1911, and thus all statutory obligations in this respect had been complied with, it was considered desirable to still further advertise the event, so as to direct public attention to its importance and to cause its advent to be anticipated and its occurrence facilitated throughout every portion of the Commonwealth, however remote or difficult of access.
- (i.) The Census Pamphlet. With the object of first bringing before the public the chief features of the purport and significance of the census a pamphlet entitled "The First Commonwealth Census," was prepared and printed, and about 25,000 copies were distributed throughout the Commonwealth during February, 1911. This pamphlet, which extended to 19 pages, was divided into six Chapters. The first was introductory and pointed out the importance of the census results as presenting a picture of national life and character; the second Chapter was historical, and gave a short rėsumė of the origin of the census with particular reference to previous Australian Censuses; the third Chapter dealt with the objects and uses of the census, whilst

in the fourth mention was made of the preparatory work involved. The nature of the personal card and the householder's card and of each query thereon were then thoroughly explained, both as to their object and the form in which it was desired that the particulars should be furnished. Finally in the sixth Chapter brief information was given in regard to the procedure that would be followed in the distribution and collection of the returns, and the methods of tabulation and analysis were touched upon.

- (ii.) Press Notices. A sufficient number of these pamphlets was first of all despatched to each State Supervisor to enable him to supply, through the enumerator, a copy to each collector, whilst retaining one for his own use and for that of each enumerator. Copies were then sent to the Editors of all the leading newspapers with a view to furnishing material for press notices of the Census, its objects and organisation.
- (iii.) Lessons to School Children. On the 31st January, 1911, a letter was sent to the Director of Education in each of the States, pointing out the probability that the work of filling in the Census schedules would to some extent devolve upon the elder children of the various families, and asking that, if practicable, arrangements might be made for giving a series of lessons to the elder scholars on the nature and requirements of the Census. With this request the several Education Departments cordially complied, and a supply of 10,000 copies of the census pamphlet mentioned above was despatched for distribution to the various head teachers, to enable them to give to the elder scholars during March a short series of lessons based thereon.
- (iv.) Census Posters. Arrangements were made with the Postmaster-General's Department, with the Railway Departments of the several States, and with the several State Commissioners of Police for the exhibition of Census Posters on notice boards and hoardings under their control. For this purpose 6,500 posters were forwarded to the Postmaster-General's Department. 4,250 posters to the Railway Departments, and 3,500 to the Commissioners of Police. A further supply of 1,100 posters was sent to the State Supervisors for distribution amongst their enumerators, with direction to have them posted in such places, in addition to those indicated above, as appeared suitable.
- (v.) Newspaper Advertisements. As a further guarantee of publicity, the Census proclamation was inserted throughout Australia, as an advertisement in the principal morning and evening daily papers of Saturday, 25th March, and Saturday, 1st April, 1911, and in the principal weekly papers of the 18th and 25th March, 1911, or the dates of issue nearest thereto.
- (vi.) Notifications in Chinese. To ensure a thorough understanding of the census provisions by the relatively large Chinese communities existing in some of the States, circulars in Chinese were prepared and forwarded to the State Supervisors for distribution by the Collectors, with the cards where such action was necessary. In addition a special advertisement was inserted in a Chinese newspaper published in Sydney, and another in a similar journal published in Melbourne.

## CHAPTER VIII.

## COLLECTION AND COMPILATION.

### SECTION 1.—DISTRIBUTION OF SCHEDULES.

- 1. Collector's Outfit.—Each collector, before commencing the work of distribution, had been supplied with the following outfit to enable him to carry out the duties of his office:—
  - 1. Requisite supply of Householders' Schedules, etc., comprising (a) Householders' Cards; (b) Personal Cards; (c) Instructions, and (d) Envelopes.
  - 2. Collector's Record Book.
  - 3. Collector's Compilation Book.
  - 4. Necessary articles of Stationery.
  - 5. Bag for holding schedules (if required).
  - 6. Certificate of Appointment.
  - 7. Map of District.

The Collector's Record Book, which each collector carried with him while distributing, contained provision for the entry of the name and address of each householder to whom a census schedule was delivered, and also for the date of such delivery. These particulars were filled in by the collector at the time. A further column in the book provided for the insertion of the date of collection, while in the event of such collection not taking place, the collector was required to furnish the reason for the omission in a column headed "Remarks." By these means provisions were made for securing a record of all schedules issued.

2. Period of Distribution.—Provision was made in the allocation of collectors' districts, and the selection of collectors, that where practicable in the more populous areas the time allowed for distribution should not exceed the four days immediately preceding Sunday the 2nd April. In outlying districts, however, the large area to be covered, and the difficulty of securing the services of suitable collectors for short periods, rendered it necessary to allow a considerable amount of latitude in the allocation of time for distribution. In some of these cases the distribution had to be commenced more than a fortnight prior to census day.

## SECTION 2.—COLLECTION.

- 1. Actual Work of Collectors.—In accordance with instructions, the actual work of collection was commenced throughout Australia on Monday, 3rd April, 1911, the collectors revisiting the houses at which census schedules had been delivered prior to Census Day. If all instructions for filling in the schedules had been carefully complied with, the collector should have found in each case that a householder's card had been duly prepared for each dwelling, and a personal card for each person who had spent the night of Sunday, 2nd April, therein, or who being absent at work, or travelling on that night, had returned to the dwelling on the 3rd April. In many cases, however, the duties of the collector were much more arduous than the mere receiving of the cards and the comparison of the number of personal cards with the particulars shewn on the householder's card to ascertain that every one had been duly accounted for. Frequently it was found that no cards had been filled in, and in numerous other cases the collector was obliged to ascertain missing particulars and insert them on the cards. Taking the Commonwealth as a whole, it may be said that this part of the work of collection was fairly well done, and though cases came to light in which collectors had exercised very little, if any, care in obtaining a supply of the missing particulars, in numerous instances the records furnished indications of painstaking zeal.
- 2. Period for Collection.—The instructions to Census Enumerators provided that in allocating the boundaries of Collectors' Districts, the area selected should, in populous districts, be such that the work of collecting the schedules should not extend over more than eight working days, i.e., that it should be completed not later than the 11th April, 1911. In remote and

sparsely populated country a longer period was allowed, but it was stipulated that every endeavour should be made to have all cards collected not later than the 24th April, 1911, thus allowing a maximum period of three weeks for collection. In actual practice it was found that in a few instances even this later limit had to be exceeded owing to the difficulty of securing suitable collectors willing to undertake the heavy travelling and other difficulties involved in the collection of some of the more remote areas.

3. Collectors' Difficulties.—Apart from the difficulties arising from the indifference, wilful neglect, or ignorance of the householders, which were met with in greater or less extent in all parts of the Commonwealth, special difficulties were experienced in some of the districts.

In some cases these took the shape of heavy floods, which, in addition to making rivers impassable, frequently had the effect of rendering the country so boggy that progress was seriously impeded. This trouble was most in evidence in Queensland, where cases occurred in which a collector was held up for a week or more at a time through stress of weather or boggy roads. In some parts of South Australia, on the other hand, droughty conditions rendered collection difficult, owing to shortage of water and scarcity of horse feed.

Enormous distances had, in some cases, to be covered by the collectors to obtain the records of a comparatively small number of persons. This was particularly the case in Queensland, Western Australia, and the Northern Territory, and added considerably to the difficulty of securing the services of suitable collectors.

Another source of difficulty, this time mainly in populous areas, arose in connection with small colonies of foreigners unable to read or speak English. These were provided for as far as possible by the appointment of interpreters, where necessary, to accompany the collector, or in some instances to undertake themselves the duties of collector. In the case of the Chinese, advertisements in Chinese were, in addition, inserted in two of the leading Chinese newspapers published in Australia, and a poster in Chinese was issued for display where necessary.

4. Preliminary Count.—For the purpose of enabling a preliminary count of the population to be made at the earliest possible date after Census Day, each collector was supplied with a compilation book, in which, when collecting his schedules, he was required to enter daily the number of persons enumerated in each household. This book was so drafted as to allow one line for each household, provision for 28 households being made on each page. The particulars provided for in respect of each household were:—(i.) Name of householder; (ii.) Mesh number; (iii.) Locality; (iv.) Number of Envelope; (v.) Total number of persons (distinguishing sexes); (vi.) Number of Aboriginals included in v. (distinguishing sexes); and (vii.) Remarks.

On completing his enumeration each collector was required to total the several pages of his compilation book, summarise the results on a special page provided for the purpose, and forward the results to his enumerator as soon as possible thereafter. A special sum of 5s. was allowed to each collector for the work involved in preparing this summary. Similarly each enumerator was required, on receipt of such returns, to check the summary by comparison with the collector's compilation book, and then forward the result by letter or wire to the Commonwealth Statistician, and also to the State Supervisor. By such means progress results for the various parts of the Commonwealth became available at the earliest possible date. On the whole the system worked well, but in some cases regrettable delays occurred, the totals for a State being, in one case, held up for a considerable time by reprehensible lack of promptness on the part of one or two collectors.

The result of the final count of the cards in the Census Office shewed that the preliminary figures understated the population of the Commonwealth by only 5512, a decrepancy of less than an eighth of one per cent. The closeness of the results reflects credit on the enumerators and collectors for the care exercised by them in compiling the returns from which the preliminary figures were derived.

The preliminary figures for the Commonwealth as a whole were completed on the 27th June, 1911, twelve weeks after the date of the census, but, as stated above, the progress results had already been made public from time to time as they came to hand. A comparison of the preliminary and final figures for each of the States is as follows, the Federal Territory being included with New South Wales, and the Northern Territory with South Australia.

State or Territory.					Preliminary Count (com-	Final Count (com-	Deficiency in Preliminary Figures.		
State	or 1e	rritory.			pleted 27th June, 1911).	pleted 30th Oct., 1911).	Numerical,	Per Thousand of Final Count	
New South Wale	<b>S</b> 1				1,648,210	1,648,448	238	0.14	
Victoria					1,315,000	1,315,551	551	0.42	
Queensland			٠.		603,908	605,813	1,905	3.15	
South Australia <sup>2</sup>	• •				411,161	411,868	707	1.72	
Western Australi	а.,				280,316	282,114	1,798	6.37	
Tasmania	• •	• •	• •	• •	190,898	191 <b>,2</b> 11	313	1.64	
TOTAL					4,449,493	4,455,005	5,512	1.24	

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

The largest actual deficiency occurred in the case of Queensland, and the largest proportional deficiency in Western Australia, but in no case was the discrepancy at all considerable.

5. Check and Return of Schedules.—Each collector, on completing his work, returned his schedules and record and compilation books to his enumerator, by whom they were required to be checked and forwarded to the State Supervisor. The State Supervisor exercised a further but necessarily less detailed check, and forwarded the material to the Census Office, Melbourne. In the majority of cases care was taken by the enumerator to see that the work done by his collectors had been carried out in accordance with instructions, but in some instances it was evident that little more had been done than to transmit to the State Supervisor the material received from the collector. As the State Supervisor was not required to check in detail the work of the collectors, the outcome of such neglect on the part of an enumerator, was that a great deal of supplementary correspondence was thrown on the Census Office before the actual tabulation of results could be proceeded with. The principal cause of this correspondence was the want of agreement in certain cases between the number of persons shewn on the householder's card and the number of personal cards received. In a large proportion of cases, where more names appeared on the householder's card than there were persons for whom personal cards had been received, it was found that absentees, and in some cases members of the family who had been dead some years, were recorded on the householder's card. Such errors should, of course, have been rectified by the collector at the time of the collection, or failing that, by the enumerator before transmitting the schedules to his State Supervisor. No attempt was made by the Census Office to collect by means of correspondence items of information which had been omitted from individual cards, as the work involved would have been prohibitive, and the delay in the census work would have been considerable.

In this connexion it may be noted that 23,384 persons failed to state their ages, while 30,468 failed to specify their birthplaces.

6. Collecting Staff.—The total number of enumerators employed in the Commonwealth as a whole in connexion with the Census was 346, giving an average population of 12,876 per enumerator. The total number of collectors employed was 6952, giving an average of 20 collectors per enumerator, and an average population of 641 per collector.

The details for the several States are as follows:—

Enumerators and Collectors Employed at the Census of 3rd April, 1911.

State.	No. of Enum- erators.	No. of Col- lectors.	Av. No. of Collectors to each Enumerator.	Population Enumerated.	Av. Population per Enumerator.	Av. Population per Collector.	Area.	Av. Area per Enum- erator.	Av. Area per Col- lector.
							sq. miles.	sq. miles.	sq. miles.
New South Wales <sup>1</sup>	93	2,028	22	1,648,448	17,725	813	310,372	3,337	153
Victoria	95	2,322	24	1,315,551	13,848	567	87,884	925	38
Queensland	62	1,042	17	605,813	9,771	581	670,500	10,815	643
South Australia <sup>2</sup>	45	634	14	411,868	9,153	650	903,690	20,082	1,425
Western Australia	28	611	22	282,114	10,075	462	975,920	34,854	1,597
Tasmania	23	315	14	191,211	8,313	607	26,215	1,140	83
TOTAL	346	6,952	20	4,455,005	12,876	641	2,974,581	8,597	428

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

It will be seen that the average population per enumerator was greatest in New South Wales and least in Tasmania, while the average per collector was greatest in New South Wales and least in Western Australia. The average area per enumerator, and also per collector, was greatest in Western Australia and least in Victoria.

## SECTION 3.—TABULATION.

1. Tabulating Staff.—For the purpose of selecting a suitable body of tabulators, an examination was held in each of the States on 8th April, 1911, at which candidates for employment were subjected to an elementary education test in Arithmetic, Spelling, and Writing, the examination being carried out by the Commonwealth Public Service Commissioner. The necessity for such a test was shewn by the fact that although 1066 candidates presented themselves, less than a quarter of these succeeded in securing 40 per cent. or upwards of full marks.

From these latter, together with officers who had already been employed on the preliminary work of the census, the compiling staff was made up. Owing to the necessity for concentrating the staff, and to the lack of sufficient accommodation, suitably situated, it was decided to work two shifts, the earlier shift commencing at 7.45 a.m., and the later at 3.30 p.m. This

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

arrangement lasted from 1st August, 1911, to 30th June, 1912. The tabulating staff reached a maximum of 270, and was reduced by fortnightly retrenchments from 15th March, 1912, to 30th June, 1912. Further retrenchments were effected from time to time as various sections of the tabulation were completed, the more competent officers being retained from stage to stage.

2. Tabulation Organisation.—For the purpose of securing adequate supervision of the tabulating staff, sections comprising ten men in each were constituted, one member of the section being placed in charge under the designation of "section leader," while one section leader in each shift was selected as the responsible officer in charge of the shift, under the designation of "shift supervisor," the work of the shifts being superintended and co-ordinated by the "tabulation superintendent," who was directly in touch with the tabulators on the one hand, and the permanent "Central Supervisor of Census" on the other. All of the officers, from the "tabulation superintendent" downwards, were temporary hands, at the following rates of pay:—

	PER DAY.	PER DAY
"Tabulation Superintendent"	15s.	Tabulators (under 21) 5
"Draftsmen and Special Computers"	10s. to 15s.	Female Adding Machinists (aged 21 and
"Shift Supervisors"	13s. 6d.	upwards) 8s
"Section Leaders"	12s. 6d.	,, ,, $(under 21)$ 5s
Storeman	12s. 6d.	PER WEEK
Tabulators (aged 21 and upwards)	10s.	Messengers (boys) 15s. to £

The method adopted in the tabulation of the data was that of employing all the staff on the same tabulation for the whole Commonwealth. This was considered preferable to the alternative method of allocating the several States to groups of tabulators to be tabulated throughout, as it simplified the work of control and storage, and by distributing the work to different tabulators at different stages tended to greater accuracy in the results.

3. Segregation of Census Cards.—One of the acts preparatory to that of tabulation was the separation of the cards from their envelopes, and the removal and destruction of envelopes and blank cards. It was necessary, however, that particulars in regard to married couples, such as the relative ages, religions, and birthplaces of husbands and wives should be extracted on "conjugal" cards before the census cards were removed from their envelopes, and it was considered expedient, both for the writing of these "conjugal" cards, and also for convenience of subsequent tabulation from the census cards, that age, birthplace, and religions should all be indicated by numbers on the space specially provided on the right hand margin of the personal card. In each case the number used for age was the age last birthday, while for birthplaces a classification under 75 heads was provided, and a similar classification under 30 heads for religions, each birthplace or religion being indicated by its classification number. Similar markings were also required in connexion with the replies to "number of children," and to "length of residence." To avoid delay in the issue of population results for electoral and Treasury purposes, the classification of occupations was deferred to a later stage.

In connexion with this process of special marking, a general check of the various items on the personal cards was undertaken with a view to correcting evident misstatements, such, for example, as length of residence in excess of age, misstatement of sex as disclosed by the statements of "Relation to head of household," and "Occupation," etc.

On the completion of this check, "Conjugal" cards were written, and census cards relating to males and females were separated, the covering envelopes being destroyed. Throughout all the succeeding processes male and female cards were separately treated.

4. Successive Tabulations.— The most pressing requirement was the ascertainment, for the purposes of the Commonwealth Electoral Office, of the population of the several States, exclusive of aliens disqualified under Section 25 of the Commonwealth Constitution. For this purpose a careful count was made of the populations in the various census meshes, and also of the number of persons of Non-European race in each State. The information respecting total population of each State was also urgently required by the Commonwealth Treasury for the purpose of allocating the subsidy of 25s. per head of population, payable to the several States under the Commonwealth Surplus Revenue Act 1910.

The next tabulation was that of ages. Owing to the importance of this item greater geographical detail was obtained than was the case with any other item of information, details for single ages being tabulated for each mesh. The succeeding tabulations in the order in which they were carried out were:—Birthplaces, Length of Residence, Religions, Education, Schooling, Blindness and Deaf-Mutism, Non-European Races, Conjugal Condition, Localities, Families, Occupations, Dwellings.

For classifying occupations prior to tabulation a special staff was selected, who devoted themselves continuously to this class of work, whilst the balance of the staff were engaged on other tabulations. For the purposes of this classification a complete index of occupations was prepared on the lines of the classification used at the Census of 1901. In classifying, each card was marked in the margin with the appropriate Order, Sub-order and Group of the occupations specified thereon.

5. Mechanical Assistance.— As mentioned when dealing with the preliminary census arrangements (p. 68), it was not considered desirable to make use of any of the existing mechanical devices for the punching, sorting, and counting of cards. With few exceptions the tabulations were carried out entirely by means of hand-sorting and personal counting. One of the exceptions to this rule was in the case of the tabulation according to localities from the householders' cards. These cards shewed, amongst other things, the number of males, females and total persons enumerated in each household, and the tabulation of the results after the cards had been sorted into locality groups was greatly facilitated by the use of electrically-propelled Burroughs' Adding Machines.

The principal work done by this machine is that of addition. It is provided with a keyboard on which any number within the range of the machine may be set up by depressing the appropriate keys. These keys remain depressed until released by depressing the recording bar, when the number so set up is printed on an attached slip, and the keyboard automatically returns to its normal position, the printed slip at the same time being automatically moved upwards one space to allow room for the next item. By continuing the process, the items to be added are obtained printed in columnar form. Finally, the pressure of the "total" key and the printing bar adds all the items recorded and prints their total at the foot of the column.

When a "total" is obtained, the machine automatically clears itself, and is ready for a fresh operation. If, however, it is desired to record intermediate totals, the pressure of the "sub-total" key and printing bar will cause the total from the commencement of the operation to any desired point to be printed, without clearing the machine, which then continues the adding process as if nothing had occurred. To prevent possibility of error, a small "s" is automatically printed after each "sub-total," and similarly an asterisk (\*) after each "total." This arrangement effects a considerable saving of time in certain of the calculations involved in statistical and actuarial work, such, for example, as the work of obtaining the total population at and above each year of age.

To enable several distinct columns of figures to be recorded and totalled at the same time, the machines used in the Census Office are provided with what is known as a "split" device. The effect of this device is that for many purposes the machine may be considered to be divided into 2, 3, 4, or 5 separate machines, capable of being operated at the same time, and recording their results on the same slip. Care needs to be taken in so using the machines, that the extreme left-hand figure of any total will not carry over into the next division. Two grades of machines are in use in the Census Office, one grade having a total range of 15 figures, and the other a total range of 17 figures. The 15-figure machine is capable of division by means of the "split" device into the following:—

- (i.) Three groups, 5 figures in each.
- (ii.) Five groups, 3 figures in each.
- (iii.) Two groups, 7 and 8 figures.
- (iv.) Three groups, 4, 5 and 6 figures.
- (v.) Three groups, 3, 6 and 6 figures.
- (vi.) Four groups, 3, 4, 4 and 4 figures.

The 17-figure machines may be divided as follows:--

- (i.) Four groups, 4, 4, 4 and 5 figures.
- (ii.) Five groups, 4, 4, 3, 3 and 3 figures.
- (iii.) Four groups, 2, 5, 5 and 5 figures.
- (iv.) Two groups, 8 and 9 figures.
- (v.) Five groups, 4, 3, 3, 3 and 4 figures.
- (vi.) Three groups, 5, 5 and 7 figures.

In addition, each of the machines may be used as a single machine of full range, but care needs to be taken in interpreting the printed results, since zeros which should occupy the initial spaces in any division are not printed, but are represented by blank spaces.

To each machine a small electric motor is attached, which is operated by pressing the recording bar, or the machines may be operated by hand.

For various computations involved in the compilation of the census data, considerable use was made of the "Millionaire" calculating machine, and several models of the "Brunsviga" all of which did satisfactory work.

#### SECTION 4.—PUBLICATION.

1. Scheme for Presentation of Results.—Throughout the "detailed tables" published in Volumes II. and III. of the Census Results, particulars are given under every head for males and females separately, and in most cases for males and females in combination. The principal cases in which results for the sexes combined have not been published, are in the "Life Tables" of Part XI., and many of the "Occupation" tabulations of Part XII. In the former of these cases the combination of sexes would be inappropriate, while in the latter the publication of full results for the sexes combined as well as for males and females separately would have added considerably to the bulk and consequent cost of the publication, without furnishing any commensurate advantage. The general plan followed in connexion with each of the subdivisions of the "Parts" into which the detailed tables are divided, has been that of giving the particulars for the Commonwealth in the earlier tables followed by similar particulars for the several States and Territories arranged in order of population. Succeeding these, summarised results for the several Metropolitan areas are given, and these are followed by summarised data in respect of subdivisions of the States and Territories, the subdivisions of each State or Territory being given in lexicographical order. In connexion with these subdivisions, it may be be mentioned that before the adoption of such subdivisional units, the Statisticians' of the several States were consulted, and the following were selected as likely to be the most serviceable: New South Wales, Counties; Victoria, Counties; Queensland, Census Districts; South Australia, Counties and Divisions; Western Australia, Statistical Districts; Tasmania, Municipalities; Northern Territory, Counties.

For these subdivisions summarised particulars in respect of Age, Birthplace, Education, Schooling, Religion, Conjugal Condition, Occupations, and Dwellings have been published in their appropriate places in the Detailed Tables. In addition, particulars as to population, and in some few cases other items, have been published for Commonwealth Electoral Divisions, State Electoral Provinces, State Electoral Districts, and Local Government Areas, as well as for all Localities containing 50 persons or more at the date of the Census.

# CHAPTER IX.

# POST - CENSAL ADJUSTMENT OF POPULATION ESTIMATES FOR THE INTERCENSAL PERIOD, 1901-1911.

1. **Census Results.**—On the 31st March, 1901—or, rather, as at the moment of midnight between 31st March and 1st April of that year—the population of Australia was determined by means of a census, taken under the census laws of the several States, the control of the necessary administrative organization being placed in the hands of the State Statisticians. The total population of the Commonwealth so found was as follows:—

Males, 1,977,928; Females, 1,795,873; Total, 3,773,801.

On the 3rd April, 1911, a similar enumeration was carried out under the control of the Commonwealth Statistician, in accordance with the Commonwealth Census and Statistics Act 1905, which itself conferred the necessary powers. The population of the Commonwealth as then ascertained was as follows:—

Males, 2,313,035; Females, 2,141,970; Total, 4,455,005.

In both cases the figures given are exclusive of full-blooded aboriginal natives of Australia, but are inclusive of half-caste aboriginals.

It should be noted, in connexion with the census of 1911, that a slight change in defining the date of reference has been made in order to accord with the English practice. In previous Australian censuses the date of the census has been taken to be that of the day preceding the midnight which is adopted as the determining point. Thus, at the census of 1901, where the figures given relate approximately to midnight between the 31st March and the 1st April, the Australian census was stated to be that of the 31st March, while in a precisely similar case in England it was stated to be that of 1st April. At the census of 1911, taken as at midnight between the 2nd and 3rd April, the date of the census has, in accordance with the English practice, been stated to be the 3rd April, and that day was gazetted as the day of the census.

2. Intercensal Records.—Between the dates of the censuses of 1901 and 1911 there elapsed 10 years and 2 days. During the whole of this intercensal period records were kept of the effect of the several elements contributing to variations in population—(i.) of the Commonwealth as a whole, and (ii.) of the component States and Territories of the Commonwealth. As regards the former, the only variations possible were additions by birth and by oversea arrivals and deductions by death and by oversea departure, where the term "oversea" refers to all countries outside the Commonwealth, and to those alone. As regards the latter—viz., the populations of the component States and Territories—inter-State migration also operates, and this may be either by land or by sea. In the case of any particular State, therefore, to which migration by land is possible, there were eight distinct sets of records kept, viz.:—(i.) births registered; (ii.) deaths registered; (iii.) oversea arrivals; (iv.) inter-State arrivals by sea; (v.) inter-State arrivals by land; (vi.) oversea departures; (vii.) inter-State departures by sea; (viii.) inter-State departures by land.

The records of inter-State migration by land are necessarily incomplete as the only particular.

The records of inter-State migration by land are necessarily incomplete, as the only particulars of this nature which it is practicable to collect are those relating to migration by rail. Incidentally, it may be observed that any efficient method of obtaining the record of overland migration, other than by rail, would be found intolerably irksome. The records of this kind exist, therefore, only in the case of those States which are connected by rail—viz., New South Wales, Victoria, Queensland, and South Australia, and then only to the extent to which such migration takes place by rail.

3. Comparison of Census Results with those Derived from Intercensal Records.—Taking, first the case of the Commonwealth as a whole, the number of births registered during the 10 years from 1st April, 1901, to 31st March, 1911, was as follows:—

Males, 552,983; Females, 525,218; Total, 1,078,201.

Against this must be set off the deaths registered, as follows:-

Males, 261,661; Females, 192,447; Total, 454,108.

The natural increase—viz., the excess of births over deaths—during the decennium was therefore—Males, 291,322; Females, 332,771; Total, 624,093.

The oversea arrivals in the Commonwealth, as recorded during the decennium, were-

Males, 456,742; Females, 208,013; Total, 664,755.

During the same period the oversea departures as recorded were—

Males, 360,705; Females, 177,318; Total, 538,023.

Thus, by the records, the net immigration to the Commonwealth—that is, the excess of oversea arrivals over oversea departures—during the decennium was as follows:—

Males, 96,037; Females, 30,695; Total, 126,732.

Taking these recorded results in conjunction with the population at the census of 31st March, 1901, an estimate of the population at 31st March, 1911, is obtained as follows:—

	Pa	articulars.				Males.	Females.	Total.
Census Population, 3: Natural Increase reco Net Immigration	lst March rded duri	, 1901 ng decennium	••	••	••	1,977,928 291,322 96,037	1,795,873 332,771 30,695	3,773,801 624,093 126,732
Estimated Population,	31st Marc	ch, 1911, based on	recorded i	ntercense	ıl data	2,365,287	2,159,339	4,524,626

In order to be able to compare this result with that obtained at the census of 1911, it is necessary to make a small allowance for the differences in date, as the above estimate relates to 31st March, 1911, while the census figures relate to the midnight which marks the termination of the 2nd April. Exact records for the first two days of April are not available, but a sufficiently close approximation is obtained by taking the one-fifteenth part of the totals recorded for that month. This gives the following results:—

Particulars.	Males.	Females.	Total.
Census Population on 3rd April, 1911	2,313,035 376	2,141,970 268	4,455,005 644
Estimated Population on 31st March, 1911, as based on census results of 3rd April, 1911	2,312,659	2,141,702	4,454,361

A comparison of this estimate for 31st March, 1911, with that for the same date based on intercensal records, indicates that the effect of using the intercensal records exactly as furnished would be the *overstatement* of the population of the Commonwealth at the 31st March, 1911, by the following numbers, viz.:—

Males, 52,628; Females, 17,637; Total, 70,265.

This overstatement indicates a steady accumulation of error at an average rate of about 7,000 per annum, and suggests the desirability of at least a check-count or minor census more frequently than once in ten years.

4. Causes of Discrepancy.—It is clear, from the nature of the case, that errors in excess or defect are probable in all records of population, and in all records of its fluctuations; and, further, that errors in defect are in most cases more likely to occur than errors in excess. That is to say, omissions to record are probably more frequent than duplications of record. Owing to the provisions made for securing accuracy, it is probable that the errors in the census records, and, in Australia, in the registration of births and deaths, are not serious in their effect on the population results. As regards records of birth, death, and migration, it may be noted, that if, in practice, birth registration was seriously defective, the effect, so far as this element alone is concerned, would be to cause the enumerated results to exceed the intercensal estimate. If any such defect has actually existed it has been much more than counterbalanced by some defect of an opposite nature, arising from other causes, and hence, in the absence of some direct evidence, the existence of such defect in any marked degree cannot be assumed. As regards the registration of deaths, the stringent provisions of the law throughout Australia in relation to certification of cause of death, and to the disposal of a dead body, renders it wholly improbable that there is any error of serious magnitude from omission to register. In the case of the census records, the fact that the taking of the census is widely advertised, that a very extensive collecting organization is instituted for the special purpose, and that every effort is made after census day to make good any omissions, renders it improbable that any appreciable defect can be attributed thereto. There remain, then, in the case of the Commonwealth as a whole, the records of oversea arrivals and departures, and there appears to be no reasonable ground for doubting that the greater

part of any ascertainable discrepancy is properly chargeable thereto. In this connexion an important point requires to be borne in mind—viz., that at the date of the census all persons on In this connexion an board of vessels in Commonwealth ports, or on voyage between Commonwealth ports, are included as part of the population of Australia, whether such persons are on board in the capacity of passengers or of crew. It is also to be borne in mind that the oversea migration recorded during the intercensal period relates practically only to passengers, and to individual members of crew actually engaged, discharged, or deserting in Australia, it being assumed that the crews of incoming and outgoing vessels substantially balance each other. It is thus clear that if, at the date of any census, there were many vessels in Australian waters, the actual population at a subsequent date might differ somewhat materially from the estimated, owing simply to the fact that the departure of certain of these vessels was not approximately counterbalanced by the arrival of others. In other words, that portion of the population of Australia, which consists of crews of oversea vessels, has always, in the compilation of Australian population statistics, been tacitly assumed, as already said, to maintain a condition of equilibrium through equality of influx and efflux. In view of the degree of uncertainty involved in this tacit assumption, it is clear that any attempt at great refinement in the matter of oversea migration statistics would be illusory and unwarranted. It is thus evident that, while the discrepancy between enumerated and estimated population arises from numerous causes, the bulk of it is due to errors of migration record. And since, as before noted, errors of omission are more probable than errors of duplication, and since, further, the resultant error is usually that of overstatement of population, it is reasonably certain that the major portion of the discrepancy is due to omission to record departures. This conclusion, which has been arrived at from general considerations, is confirmed by actual experience, as it has been found that in many cases discrepancies have arisen through late bookings or passages taken on board, thus resulting in unrecorded departures.

- 5. Adjustment of Discrepancy.—For practical purposes it has been found convenient to attribute the whole of the discrepancy to defects in the records of departure, and, in readjusting population estimates between two censuses, to ascertain the ratio of the discrepancy to the aggregate recorded departures, in order to apply this ratio to the departures recorded for successive periods. This method does not appear to be open to any serious objection. Since it is simple in application and gives results which are probably not wide of the truth at any moment during the intervening period, and in the aggregate are doubtless as accurate as figures furnished by any other possible method, it has been adopted on the present occasion for adjusting the Commonwealth population estimates for the whole of the intercensal period.
- 6. Adjustment of Commonwealth Discrepancy.—From the figures given in paragraph 3 above it will be seen that the discrepancy, as ascertained for 31st March, 1911, represented approximately 14.59 per cent. of the aggregate male oversea departures for the decennium, and approximately 9.95 per cent. of the aggregate female oversea departures. Applying these percentages to the recorded oversea departures for the successive periods the requisite corrections are derived by means of which an adjusted estimate of the population of the Commonwealth is obtained for successive quarters throughout the intercensal decennium. A comparison of the results so obtained with the estimates published from time to time by the Commonwealth Bureau of Census and Statistics is important, as shewing to what magnitude the errors in question can accumulate, and is as follows:

POPULATION	N OF	THE (	OMM	) IX	VEALI	1.
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31st	Commonwealth Intercensal Estimate.		Adjustmer	nt on basis o Results.	of Census	Excess of Intercensal Estimate over Post-censal Adjustment.			
Dec.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
1901	2,006,784	1,819,502	3,826,286	2,004,836	1,820,077	3,824,913	1,948	_ 575	1,373
1902	2,037,710	1,845,369	3,883,079	2,028,008	1,847,310	3,875,318	9,702	- 1,941	7,761
1903	2,059,444	1,867,525	3,926,969	2,045,144	1,871,448	3,916,592	14,300	- 3,923	10,377
1904	2,092,818	1,891,572	3,984,390	2,072,783	1,901,367	3,974,150	20,035	- 9,795	10,240
1905	2,133,978	1,918,452	4,052,430	2,100,118	1,932,859	4,032,977	33,860	14,407	19,453
1906	2,173,545	1,945,936	4,119,481	2,126,730	1,964,755	4,091,485	46,815	-18,819	27,996
1907	2,212,480	1,984,557	4,197,037	2,160,213	2,001,509	4,161,722	52,267	- 16,952	35,315
1908	2,252,027	2,023,279	4,275,306	2,193,981	2,038,297	4,232,278	58,046	-15,018	43,028
1909	2,305,637	2,068,501	4,374,138	2,242,215	2,081,745	4,323,960	63,422	-13,244	50,178
1910	2,365,549	2,117,347	4,482,896	2,296,308	2,128,775	4,425,083	69,241	-11,428	57,813

Note. - denotes excess of post-censal adjustment over intercensal estimate.

Incidentally, it may be here noticed, that the methods adopted up to 1906 inclusive, shew a persistent and increasing tendency to underestimate the female population of the Commonwealth (indicated by the minus sign).

7. Intercensal Estimates of State Populations.—Having ascertained the adjusted results for the Commonwealth as a whole, the next problem was that of adjusting the populations of the several States in such a manner as to furnish results which, in the aggregate, would coincide for any date with that already determined for the whole Commonwealth. The data available for this purpose, in addition to the birth and death records and the returns of oversea arrivals and departures, comprised returns of inter-State migration by sea and by rail. Up to the end of 1906 these inter-State records had been compiled on the basis of returns and computations of the several State statistical authorities; but from the beginning of 1907 onwards they have been based on returns specially collected on behalf of the Commonwealth Bureau of Census and Statistics. In the earlier period, as each State was acting on its own account, without any definite system of co-ordinating the results for the Commonwealth as a whole, the question of ensuring that the State aggregates should coincide with the results for the whole Commonwealth was not in any way considered. As a matter of fact, a Commonwealth total obtained by adding together the State was usually considerably in error. It has been found that by this process the Commonwealth population, or its distribution according to sex, was varied materially from no other cause than a transfer from one State to another. After a careful consideration of this aspect of the question, the Commonwealth Statistician, who under the laws of the Commonwealth is solely responsible for the estimates of population, decided that such an anomalous position of affairs could not be allowed to continue, and consequently a system was introduced under which, for any period, all inter-State arrivals were duly accounted for as departures from other States-viz., the States from which they were reported to have come. This principle was applied to inter-State migration both by sea and by rail. In the case of migration by rail there were, up to the end of 1907, in operation no less than three distinct methods of recording such migration-

- (a) by single ticket records (Victoria and South Australia);
- (b) by return ticket records (New South Wales);
- (c) by actual count at border stations (Queensland).

In the case of ticket records, as no information was available concerning the sexes of the persons travelling on these tickets, an assumption was made that the proportion of the two sexes in the migration to or from any State by rail might be regarded as the same proportion ascertained to exist in the corresponding migration by sea. This naturally led to anomalous results. For example, a train-load of passengers leaving Victoria would, as departures from that State, be distributed as regards sex in proportion to the Victorian departures by sea, but the same train-load, on arriving in New South Wales, would be distributed as regards sex in the proportion of New South Wales arrivals by sea. By such means the sex distribution of the population of the Commonwealth would be altered merely by a transfer of population from one part of the Commonwealth to another. Such extraordinary inconsistencies were wholly ignored by the State statisticians, since they were concerned only with the results as deduced for their own States; but they could not be ignored by anyone dealing with the population of the entire Commonwealth—a fact which reveals very clearly the advantage of a central authority dealing with the question. A consideration of all the facts led to the conclusion that, for the compilation of statistics of inter-State migration by sea, only records of arrivals should be used, these being also preferable, as already pointed out, on other grounds The analysis of such arrivals according to States of departure give the requisite statistics of departures, and ensure that the population of the Commonwealth shall not be increased or diminished by the mere fact of transfer from one State to another. In the case of inter-State migration by rail, the system of counting at border stations is preferable to the ticket system, for the following reasons:-

- (i.) Statistics of sex can be obtained direct.
- (ii.) All migration by rail will be recorded, regardless of whether the traveller has or has not a ticket, or is adult or infant.
- (iii.) It furnishes a direct count, instead of compelling the statistician to rely upon questionable inferences.

Under the ticket system, not only is sex not registered, but through-passengers, passengers on season tickets and passes, and infants go unrecorded. Moreover, the actual ticket records are not identical in the several States, and consequently in this case also fictitious gains or losses to the Commonwealth result from the mere fact of inter-State transfers. In short, the system is one which does not arithmetically balance, and must consequently be rejected as inherently unsatisfactory. On the other hand, under the system now adopted by the Commonwealth, every inter-State credit of population to any State is accompanied by a corresponding debit to some other State, thus maintaining consistency of total population, which consistency, as already explained, did not exist in the method superseded.

8. Post-Censal Adjustments of State Populations.—One of the first steps to be taken in the post-censal adjustment of the State populations for the decennium 1901–11 was that of remedying the defect due to the want of identity between aggregate inter-State arrivals and departures for the successive quarters of the earlier portion of the decennium—that is, to the end of 1906. The figures for 1907 were so adjusted when the Commonwealth system of migration was introduced in 1908, and figures for succeeding years were so determined as to require no such adjustment. For the purpose of this adjustment to the end of 1906, the inter-State departures by sea and by rail were dealt with separately. In each case the recorded inter-State departures for any quarter for each State were multiplied by such a factor as would make the aggregate inter-State departures for the quarter identical with the aggregate inter-State arrivals. As regards oversea migration to and from the several States, the arrivals were allowed to stand as recorded, while the departures for each State were corrected by means of the factor determined for the Commonwealth as a whole. This was necessary, inasmuch as there was no direct warrant for preferring the records

of any particular State as being more accurate in this respect than the records of any other State. After these adjustments had been effected, there still remained a correction for the defective record of inter-State migration, other than the want of coincidence between the aggregates of arrivals and departures. The extent of this residual error in the case of each sex in each State was determined by computing, from the adjusted figures derived in accordance with the foregoing scheme, the estimated population of each sex as at 31st March, 1911, and comparing this with the corresponding figure deduced from the records of the census of 3rd April, 1911. As the result of this comparison it was found that the residual errors, remaining for adjustment, were as follows:—

State				Males.	Females.	Persons.
New South Wales Victoria				- 4,399	- 1,736 - 495	- 6,135 + 5,182
	• •	• •	• •	+ 5,677		
Queensland	• •	• •	• •	<b>– 10,039</b>	- 155	- 10,194
South Australia			• •	+ 13,933	+ 2,179	+ 16,112
Western Australia				- 549	+ 598	+ 49
Tasmania	••	• •	• •	- 4,623	391	- 5,014
Commonwealth						

It was necessary that these errors should be so adjusted that at any point of time during the decennium the aggregate of the several adjustments should be zero. The application of the correction as a percentage, on, say, recorded departures, would in practice involve awkward complications. A careful consideration of this matter led to the conclusion that a uniform distribution of the error in each case over the 40 quarters comprised in the decennium would probably accord as closely with the actual (but unknown) facts as any that could be devised, and would, in addition, be simple in application as well as satisfactory from the standpoint of Commonwealth total The corrections so applied to the figures for the several quarters were approximately as follows:—

State.		Males.	Females.	Persons.	
New South Wales Victoria Queensland . South Australia Western Australia Tasmania	· · · · · · · · · · · · · · · · · · ·	+ 110 - 142 + 251 - 348 + 14 + 115	+ 43 + 12 + 4 - 54 - 15 + 10	+ 153 - 130 + 255 - 402 - 1 + 125	
Commonwealth .	• ••.			_	

On the basis of these principles the populations of the several States as at the end of each quarter from 31st March, 1901, to 31st March, 1911, have been determined, and from these the mean populations for the several intercensal years have been computed. These re-computed means have been employed in the adjustment of all intercensal rates based upon population.

# CHAPTER X.

## AGES.

- 1. Form of Inquiry.—A striking feature of the results of any Census tabulated according to single ages is the tendency for accumulations at ages which are multiples of 5, and especially at ages which are even multiples of 5, that is to say, ages which end in 0. Owing to this tend-ency, the results of the present Census shewed that 74,013 persons had given their ages as 30, whilst only 70,496 gave 29, and only 68,200 gave 31. Similarly, whilst 46,872 persons gave 50 as their age, only 43,785 gave 49, and only 39,413 gave 51. It is clear that under ordinary circumstances the number of persons aged 30 should not differ materially from the number aged 29 or 31, or the number aged 50 from the number aged 49 or 51. In many cases there is little doubt that the age is incorrectly stated in round numbers, owing to the fact that nothing more definite is known, while in other cases the misstatement is due either to indifference or to intention to mislead. At previous Censuses in Australia the form of inquiry on the Census Schedule was that of asking the age last birthday. On the present occasion this was amended by asking the date of birth, and in addition asking that those whose date of birth was unknown should state their age last birthday. In the majority of cases the date of birth was inserted, but judging by the results obtained, it would appear that in some of these instances the year of birth must have been computed on the basis of what the person assumed to be his or her age last birthday. The results, however, taken on the whole, did not exhibit as great a degree of irregularity at and around quinquennial ages as was shewn in the results for 1891 This suggests that the ages were stated with a higher degree of general accuracy than This is a matter for congratulation in view of has characterised previous Australian Censuses. the important purposes for which statistics of age are required, and indicates an increasing appreciation on the part of the community of the desirability of furnishing accurate age returns. There is little doubt that if people generally had any realisation of the value and range of application of statistics of age there would be little difficulty in getting more accurate returns.
- 2. Ages Unspecified.—For the Commonwealth as a whole the number of persons whose ages were unspecified was 23,384, of whom 12,401 were males, and 10,983 were females. It thus appears that the number who failed to state their ages represented 5.36 per 1000 of total male population, and 5.13 per 1000 of total female population. An examination of the other particulars on the Census Cards in the case of persons of unspecified age frequently enabled a fairly accurate idea to be obtained of the period of life in which the person was, that is, whether the card related to an adult or a child. The terms "adult" and "child" are here used somewhat loosely, and without any very clearly indicated line of demarcation. In some cases, however, such a distinction was not practicable, as certain of the cards received contained little more than the name and sex of the person enumerated. On completion of the age tabulation the number of such cards for each sex in each State and Territory was divided into the two groups of "Adults" and "Children," in proportion to the numbers directly allocated to these groups. The total numbers so obtained for the several States and Territories are as follows:—

# Approximate Distribution into Adults and Children of Persons of Unspecified Age.

						STATES.						TOTAL,
Par		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth		
						MALES.						
Children Adults	••	•••		631 3,859	602 2,657	MALES.  214 1,768	115 803	108 1,044	101 431	1 59	3 5	1,775 10,626

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Approximate Distribution into Adults and Children of Persons of Unspecified Age-continued.

		STATES.						TERRITORIES.		TOTAL			
Par	FICULA	RS.		N.S.W.	Vic.	Q'land.	S.A.	WA.	Tas.	N.T.	F.T.	C'wlth	
						FEMAI	LES.						
Children Adults				548 3,255	570 3,210	177 1,007	143 811	153 567	92 438	4	4 4	1,687 9,296	
TOTAL	••		••	3,803	3,780	1,184	954	720	530	4	8	10,983	
						PERS	ons.						
Children Adults				1,179 7,114	1,172 5,867	391 2,775	258 1,614	261 1,611	193 869	1 63	7 9	3,462 19,922	
TOTAL			٠.	8,293	7,039	3,166	1,872	1,872	1,062	64	16	23,384	

The figures given in this table were then distributed over the ages 0–14 in the case of "Children," and 15 to oldest age in the case of "Adults," in proportion to the numbers recorded at individual ages in these two sections of the table.

3. Single Age Comparisons with previous Censuses.—For the purpose of enabling a comparison to be made with the corresponding results for previous Censuses, the figures for the Censuses of 1891 and 1901 were also adjusted to allow for persons of unspecified age. In the case of Queensland the Census returns for 1891 and 1901 gave single ages for the period 0–14, then a quinquennial group (15–19) followed by a single age (20), a quadrennial group (21–24), and quinquennial ages thence forward. To enable a total for single ages for the Commonwealth as a whole to be obtained, the figures for the various age groups in the Queensland returns were distributed over the ages comprised in such groups in the proportions shewn by the corresponding figures for the rest of the Commonwealth. The assumption involved in such a distribution, although somewhat arbitrary, furnishes results which are probably not very wide of the truth. The comparative results so obtained for Males, Females, and Persons will be found in Table No. 7 of Census Detailed Tables, Part I., Ages. (See Vol. II., pp. 15 and 16).

This table furnishes interesting evidence of the greater regularity of the 1911 age results already referred to in section 1, above. As an illustrative example, the figures for ages 28, 29, 30, 31 and 32 may be taken:—

Number of Persons Recorded at Single Ages in Group 28-32.

Age Last			Number of	of Persons F	RECORDED.	Proportion per cent. of Aggregate for the Five Ages 28-32.				
Birti	Birthday.		1891.	1901.	1911.	1891.	1901.	1911.		
90			65,518	06 220	76,467	23.24	% 21.44	$\frac{\%}{21.45}$		
28	• •	• • •		66,336		19.82				
29	• •	• •	55,871	59,513	70,961		19.23	19.90		
30	• •	• •	65,849	71,105	74,504	23.35	22.98	20.90		
31			44,752	52,302	68,651	15.87	16.90	19.25		
32	• •	• •	49,965	60,208	65,962	17.72	19.45	18.50		
TOTAL.	28-32		281,955	309,464	356,545	100.00	100.00	100.00		

Under normal circumstances, and in the absence of fairly extensive migration, or marked variations in the number of births and deaths, if ages were correctly stated in a group such as that given above, the number at age 30 would represent approximately 20 per cent. of the total for the group, while the number for each age under 30 would be greater, and the number at each age above 30 would be less than 20 per cent. of the total for the age-group. The evidence furnished by the table is, that, in the case of age 30 and adjacent ages, there was much greater accuracy of statement in 1911 than at the two preceding Censuses.

To take another example, the following table furnishes similar results in connexion with age 50:—

Number of	Dorgona	Doogsdod	o.t	Single	Δαοσ	in	Gnoun	40 50	
Number of	rersons	Recorded	aı	2mare	Ages	111	Group	48-DZ.	

	AGE LAST			Number	of Persons	Recorded.	Proportion per cent. of Aggregate for the Five Ages, 48-52.			
	BIRT	HDAY.		1891.	1901.	1911.	1891.	1901.	1911.	
48				25,184	29,103	48,777	% 21.26	% 21.81	${22.49}$	
$\overline{49}$				21,177	25,846	44.073	17.88	19.37	20.32	
<b>5</b> 0				34,425	34,381	47,185	29.06	25.77	21.75	
51				16,588	20,033	39,673	14.00	15.02	18.29	
52	• •			21,078	24,054	37,187	17.80	18.03	17.15	
$\mathbf{T}$	OTAL,	48-52		118,452	133,417	216,895	100.00	100.00	100.00	

From this table again it is clear that the results for 1911 are much more consistent, and, consequently, are probably much more accurate than those for the two preceding Censuses. It may be noted in passing, that the figures for ages 48 and 52, taken together, represented in 1891 39.06 per cent. of the aggregate for the five ages, 39.84 per cent. in 1901, and 39.64 per cent. in 1911. In a normally constituted population, the proportion per cent. for these two ages would approximate to 40 per cent. of the total for the five ages, and the fact that at all three of the Censuses such an approximation was obtained, renders it improbable that the excess at age 50 was due to any great extent to deficiencies at ages 48 or 52. On the other hand, the corresponding percentage for ages 49 and 51, taken together, viz., 31.88 per cent. in 1891, 34.39 per cent. in 1901, and 38.61 per cent. in 1911, suggests the probability of a heavy transfer from these ages to age 50, the extent of such transfer, however, diminishing with succeeding Censuses.

- 4. Age Grouping.—In the compilation of statistics of population, or of demography generally, the amount of detail involved usually renders it impracticable to deal throughout with results for single ages. It consequently becomes necessary to adopt some method of grouping for the tabulation of data according to age. The method which has been very generally employed in statistical offices throughout the world, is that of quinquennial grouping with a multiple of 5 at the beginning of each group, as for example, 10–14, 15–19, 20–24, etc. For the majority of purposes at the present Commonwealth Census this method of grouping has been followed, since comparisons with results of previous Censuses and with tabulations of statistical data generally for Australia and other countries are thereby facilitated. As already noted, an examination of the Census results for single ages discloses the fact that the heavy accumulations of misstated ages appear at ages ending in 0, and also furnishes an indication that these accumulations are drawn from both sides of the ages ending in 0, and in the main from the ages immediately adjacent on either side. These facts suggest that a desirable method of grouping would be such as would associate the age at which accumulations appear with those from which such accumulations have been drawn, that is to say, that in the case of quinquennial arrangement of data, the grouping should be 13–17, 18–22, etc. As mentioned above, it has not been considered desirable on the present occasion to interfere with the usual grouping, commencing with a multiple of 5, particularly as this grouping lends itself readily, if required, to a decennial rearrangement with the age ending in 0 in the middle, as for example, 15–24, 25–34, etc.
- 5. Discrepancy at Infantile Ages.—A case of misstatement of age is frequently disclosed by the Census results relative to young children. Where, as is usually the case, the migration of very young children is practically negligible, and birth and infantile death-rates are not subject to marked fluctuations, the number of children at successive infantile ages last birthday should diminish from age 0 last birthday onwards.

In many cases, however, it has been found that the number of children returned as between the ages of 1 and 2 is not only less than the number returned as under 1 year of age, but is also less than the number returned as between the ages of 2 and 3. In Australia this sort of error does not appear very markedly in recent Censuses, as will be seen from the following table, giving the results for both sexes for the last three Censuses:—

Numbers Recorded in Australia at Infantile Ages.

Age last Birthday.	1891.	1901.	1911.	Age last Birthday.	1891.	1901.	1911.
0	96,009 87,163 90,165	93,324 84,979 84,699	115,970 107,485 101,693	3 4	88,428 85,807	86,002 86,113	102,342 99,433

It will be seen that for the Census of 1891 the number recorded at age 2 was greater by 3,002 than at age 1, and that in 1901 the number at age 2 differed by only 280 from the number at age 1, but fell short by 1,303 of the number at age 3. In the case of the Census of 1911 the numbers at successive ages declined in fairly regular order for ages 0, 1, and 2 last birthday, but increased by 649 from age 2 to age 3. The divergence in 1891 between ages 1 and 2 is probably due largely to inaccuracy of statement, but those in 1901 and 1911 are of such a nature that they may possibly be accounted for in part by immigration.

6. Comparisons of Infantile Census Returns with Registration Records.—If the registrations of births were complete, and were in such a form as to shew the exact number of births which occurred in any given calendar or other year, and if in addition the deaths under one year of age for that year could be analysed so as to shew separately deaths arising from births which occurred in that year, and deaths arising from births which occurred in the preceding year, it is clear, since the net migration of infants under one year of age is necessarily small, that the subtraction of these deaths from the births recorded for the year would give approximately the number of children who should be shewn as aged 0 last birthday on the returns of a Census taken at the end of the year, that is, the number who, at the date of the Census, were living and were under the age of one year.

Although these particulars are not available in the form specified, fair approximations to them can be obtained from the existing records. For the year ended 31st March, 1911, the number of births registered in Australia was 118,369, of which 61,003 were males, and 57,366 were females. During the same period the number of deaths under one year of age registered was 8,359, of which 4,787 were males, and 3,572 were females. What is required to be known is the number of these deaths which arose from births which took place in the year ended 31st March, 1911. Having this number, its subtraction from the number of births for that year would give approximately the number of registered children under one year of age living at the 31st March, 1911. The fact that statistics of deaths under one year of age for the year in question were available in considerable detail, enabled a fairly accurate estimate of the required number of deaths to be obtained. The following example, based on the deaths under one year for the whole Commonwealth, will render the process clear:—

Deaths Under One Year of Age, Registered in the Commonwealth during the Year ended 31st March, 1911.

Age at Doath.		ınder One Registere		roximate Propor- whose Birth Oc- ed in the Year d 31st Mar., 1911.	Estimated number of Deaths during Year ended 31st March, 1911, arising from Births which took place in that Year.				
	Males.	Females	Total.	Approximate tion whose B curred in the ended 31st Ms	Males.	Females.	Total.		
Under 1 week	1,458	1,028	2,486	183	1,444	1,018	2,462		
week and under 2 weeks	274	198	472	104	266	193	459		
weeks and under 3 weeks	188	143	331	99 104	179	136	315		
weeks and under 1 month	170	105	275	97 104	159	98	257		
1 month and under 2 months	445	329	774	21 24	389	288	677		
2 months ,, ,, 3 ,,	360	254	614	19 24	285	201	486		
3 ,, ,, ,, 4 ,,	356	241	597	174	252	171	423		
4 ,, ,, ,, 5 ,,	255	216	471	15 24	159	135	294		
5 ,, ,,- ,, 6 ,,	225	201	426	$\frac{13}{24}$	122	109	231		
6 ,, ,, ,, 7 ,,	222	166	388	$\frac{1}{2}\frac{1}{4}$	102	76	178		
7 ,, ,, ,, 8 ,,	194	168	362	$\frac{9}{24}$	73	63 .	136		
8 ,, ,, ,, 9 ,,	170	149	319	24	50	43	93		
9 ,, ,, ,, 10 ,,	177	127	304	$\frac{5}{24}$	37	26	63		
0, , , 11, .	145	124	269	3 24	18	16	34		
1 ,, ,, ,, 12 ,,	148	123	271	24	6	5	11		
TOTAL	4,787	3,572	8,359		3,541	2,578	6,119		

It appears from the foregoing table that of the 8,359 deaths under one year registered during the year ended 31st March, 1911, approximately 6,119 or 73.20 per cent. were the deaths of children who had been born in that year. The percentages for males and females separately were 73.97 and 72.17 respectively.

The rationale of the process of estimation may be stated as follows:—

Of the deaths in any year of children aged under one week, all except those who died in the first week of the year must have been born in that year, while of those who died in the first week, a proportion would have been born in the preceding year. In the above calculation, this proportion has been assumed to be  $\frac{1}{2}$ , which is probably somewhat too high, but not sufficiently

so to seriously affect the results. In consequence of this assumption,  $\frac{51\frac{15}{52}}{52}$  or  $\frac{103}{104}$  of the whole year's deaths are taken. Similar explanation applies to each of the other ages.

It may be noted that percentages, ranging from 71.5 to 74.2, have been found to hold for other years for which similar investigations have been made. It may consequently be stated that according to present Australian experience, of all deaths under twelve months of age occurring in any given year, approximately 73 per cent. are those of children born in that year.

Similar calculations to that described above have been made for the several States for the year ended 31st March, 1911, and the figures obtained have been compared with the registration returns. The results obtained are as follows:—

Comparison of Census and Registration Results for Infant Ages.

STATE.	Births Registered during the Year ended 31st March, 1911.	Approximate Number of Deaths in Year ended 31st March, 1911, arising from Births in that Year.	Estimated Number under One Year of Age at 31/3/11 based on Registration Returns.	Census Results.	Excess of Census Results over Regis- tration Estimate.
		MALES.			
New South Wales Victoria	16,524 8,492 5,444 3,908	1,393 946 451 305 242	22,310 15,578 8,041 5,139 3,666	22,957 15,869 8,329 5,378 3,808	647 291 288 239 142
Tasmania Commonwealth	61,003	3,541	57,462	2,761 59,102	1,640
		FEMALES.			
New South Wales Victoria Queensland South Australia Western Australia Tasmania	22,446 15,270 8,031 5,166 3,776 2,677	1,021 668 332 225 177 155	21,425 14,602 7,699 4,941 3,599 2,522	22,136 15,089 7,967 5,124 3,684 2,584	711 487 268 183 85 62
Commonwealth	57,366	2,578	54,788	56,584	1,796
	·	TOTAL.			
New South Wales Victoria Queensland South Australia Western Australia Tasmania	46,149 31,794 16,523 10,610 7,684 5,609	2,414 1,614 783 530 419 359	43,735 30,180 15,740 10,080 7,265 5,250	45,093 30,958 16,296 10,502 7,492 5,345	1,358 778 556 422 227 95
Commonwealth .	. 118,369	6,119	112,250	115,686	3,436

In connexion with a comparison such as that given above, there are certain causes operating to prevent absolute identity in the two sets of returns. The principal of these are :—

- (i.) The fact that the births and deaths registered in any year do not represent the occurrences of that year;
- (ii.) The fact that whilst deaths are registered within a few days of their occurrence, births are frequently not registered for over two months after they occur;
  - (iii.) The fact that there is often a tendency at early ages to misstate age;
  - (iv.) The fact that the migration of infants, although small, is yet not entirely negligible

In view of these facts, it must be admitted that the divergences between the two sets of results are very small, and as these results have been obtained by organisations which are entirely distinct from each other, it may be said of the Census and Registration returns, that each furnishes an indication of the substantial accuracy of the other.

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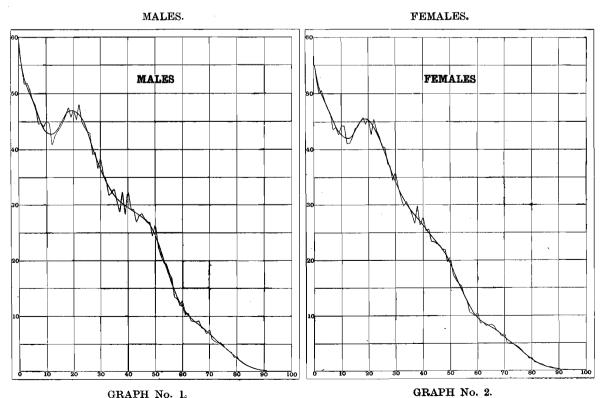
7. Smoothed Results.—As previously mentioned in Sections 1 and 3 above, the results obtained by tabulation of the replies to the age query on the Census cards, furnished indications of tendencies to misstate ages in such a way as to give unreasonable accumulations at ages ending in 0 and 5. With a view to obtaining results which are more nearly in accord with the actual facts than are the tabulated replies, a process of smoothing was applied to the figures for each sex for each of the States and Territories for the present Census. A similar process was also applied to the figures for the Commonwealth as a whole for the Censuses of 1881, 1891 and 1901. These smoothed results will be found in Tables 9, 10, 11 and 18 of Part I. (Ages) of the Detailed Census Tables. (See Volume II., pp. 17-22 and 32-33)

The method adopted in carrying out the smoothing process was as follows:—The number of persons of either sex for each age or group of ages last birthday, from 0 upwards, was plotted as a rectangle on cross-ruled paper, the base of each rectangle being a length proportional to the number of years contained in the age group involved, and the height being so determined that the area of the rectangle would represent proportionally the number of persons in that age group. Through the upper part of these rectangles a smooth curve was drawn in such a manner that the area contained between it and the base would in some cases be greater and in others less than the area of the corresponding rectangle, the principle involved being that of making the excesses balance the defects within as short a range as practicable, consistently with the maintenance of a fair degree of smoothness in the curve. From the curve so drawn values were read off for determining the areas which had by its means been substituted for the original rectangles, and these areas were compared item by item with the original data. A table shewing the deviations from the data at each point, the accumulated deviations up to that point, and the first differences of the readings was then prepared. Where these results indicated that the curve had, over a given range, been taken too low or too high, or that the sweep of the curve was less regular than was desirable, the necessary adjustments were made in the readings, and the resulting deviations were tested. By these means, adjustments of the original observations were obtained which conform closely to the two principal requisites of a good graduation, viz.:—

- (i.) That the resulting curve should exhibit a reasonable degree of smoothness;
- (ii.) That it should satisfactorily fit the original data.

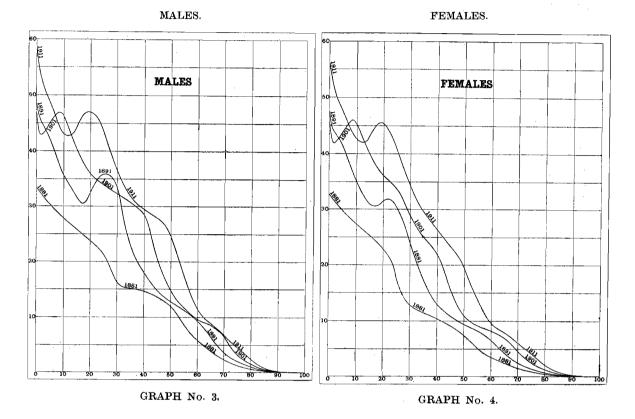
Graphs Nos. 1 and 2 hereunder represent the crude data and the adjusted results for males and females respectively for the Commonwealth as a whole at the Census of 1911. In each case the base of each small rectangle represents a period of age of ten years' duration, and the vertical height represents 5,000 persons. The serrated line in each case represents the crude data as furnished by the Census cards, while the curve represents the adjusted results obtained by the method outlined in the present section. In this case the crude data are represented, not by areas, but by ordinates drawn at the appropriate points and connected at their upper extremities to indicate their relation to the smooth curve.

Ages of Commonwealth Population, Crude Data and Adjusted Results.—Census of 1911.



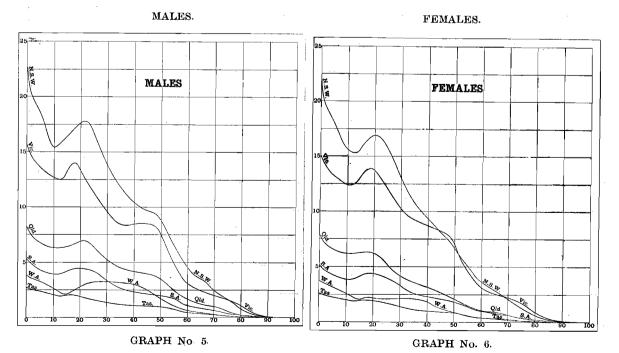
Graphs Nos. 3 and 4 hereunder relate to adjusted results only at the Censuses of 1881, 1891, 1901 and 1911, for the Commonwealth as a whole. They furnish an interesting view of the growth of the population of Australia at all ages during the 30 years under review. The scale in this case is identical with that for graphs 1 and 2. The corresponding numerical results will be found in Volume II. pp. 32-33.

Ages of Commonwealth Population, Adjusted.—Censuses 1881, 1891, 1901, and 1911.



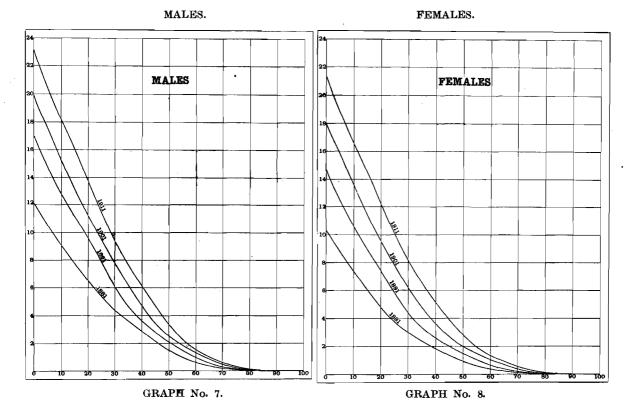
Graphs Nos. 5 and 6 hereunder furnish a representation of the age data in respect of the several States at the Census of 1911. In this case the vertical height of each small rectangle represents 2,500 persons. The corresponding numerical results will be found in Volume II. pp. 17-20.

Ages of Population in each State, Adjusted Results.—Census of 1911.



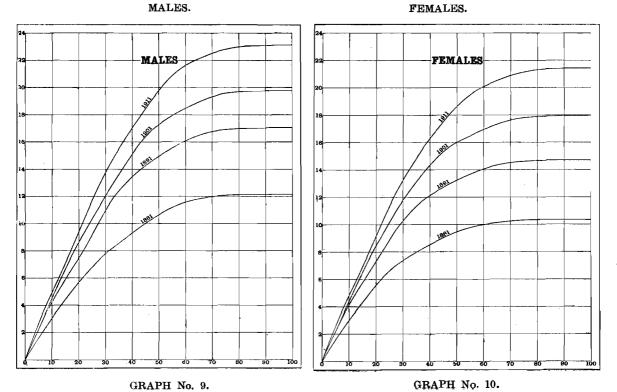
Graphs Nos. 7 and 8 hereunder furnish a representation of the number of persons of each sex who were, at and above each age at the Australian Censuses 1881 to 1911. In these cases the height of each small square represents 200,000 persons.

Commonwealth Population at and above each Age, Adjusted Results.—Censuses 1881, 1891, 1901, and 1911.



Similarly Graphs Nos. 9 and 10 hereunder furnish a representation of the number of persons of each sex who were under each age at the Australian Censuses of 1881 to 1911. In these cases the height of each small square represents 200,000 persons.

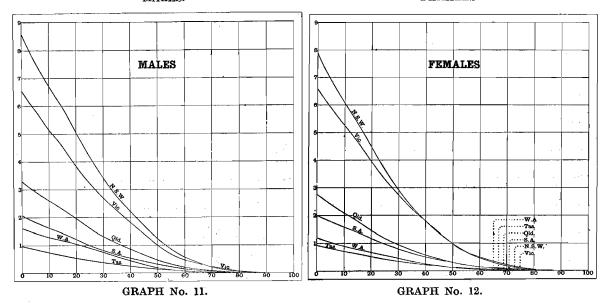
Commonwealth Population below each Age.—Censuses 1881, 1891, 1901, 1911.



Corresponding to Graphs Nos. 7 and 8 above for the whole Commonwealth at the last four Censuses, Graphs Nos. 11 and 12 hereunder furnish a representation of the male and female population of the several States, at and above each age, at the Census of 1911. In these cases the height of each small square represents 100,000 persons. The corresponding numerical results will be found in Volume II., pp. 22-25.

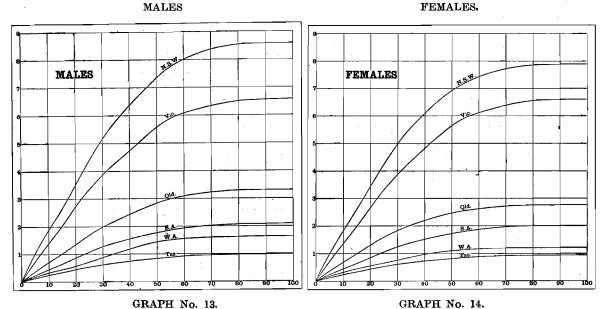
Population in States at and above each Age, Adjusted Results.—Census of 1911.

MALES. FEMALES.



Corresponding to Graphs Nos. 9 and 10 above for the whole Commonwealth at the last four Censuses, Graphs Nos. 13 and 14 hereunder furnish a representation of the male and female population of the several States, under each age at the Census of 1911. In these cases the height of each small square represents 100 000 persons. The corresponding numerical results will be found in Volume II., pp. 27-30.

Population in States under each Age, Adjusted Results.—Census of 1911.



8. Masculinity According to Age.—The "masculinity" or "femininity" of the population indicates the extent to which either sex predominates in the total, and may be computed in various ways. A method which has been used very extensively is that of calculating the ratio of the number of males to the number of females, the result being usually multiplied by 100, and generally quoted as the "masculinity" or the "number of males to each 100 females." The reciprocal of this ratio, also multiplied by 100, would give the "femininity" or the "number of females to each 100 males." A second method which has been used is that of calculating the ratios of the number of males and of females respectively to the total population. These multiplied by 100 may also be called the "masculinity" and "femininity" respectively. A third

AGES

method, which has theoretical advantages over either of the others mentioned, and which is, in addition, more convenient in practice than that first quoted, consists in calculating the ratio between the excess of males over females, or excess of females over males to the total population. For convenience of reference this result may, as in the case of the two other methods, be multiplied by 100. In this case the "femininity" will be the arithmetical complement of the "masculinity." Thus, if the "masculinity" were represented by +6, the "femininity" would be represented by -6, and each would signify that in an average hundred of the population under review, the number of males exceeded the number of females by 6, in other words, that there were 53 males to each 47 females. The following table furnishes particulars for the several States and Territories, and for the Commonwealth as a whole, deduced from the adjusted Census results for quinquennial age-groups. The figures given represent in each case the "masculinity" of the population, in accordance with the third method described above.

Masculinity of Population. (Excess of Males over Females in each 100 of Population.)

		e Las	-				Sı	ATES.			TERRI	TORIES.	
	Bir	THDA	Y.		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	С'WLТН
0-4					1.39	1.69	1.87	1.51	1.27	2.37	2.30	8.70	1.59
5-9			• •		.56	1.27	1.40	.92	1.59	2.30	1.09	1.16	1.06
10-14					1.11	.41	1.20	.88	.41	1.39	2.36	.51	.87
15-19					1.80	.48	2.35	.47	4.75	1.29	7.89	10.10	1.49
20-24					2.94	2.48	7.41	1.67	16.11	-2.41	50.53	25.61	2.47
25-29					2.75	3.11	10.78	1.79	20.63	2.28	54.84	30.43	3.16
30-34					3.73	4.09	11.28	.98	19,61	1.27	56.64	26.67	3.49
35 - 39					4.68	-3.75	12.44	.75	20.63	5.49	75.76	25.23	4.36
40-44					6.55	07	15.83	.91	28.07	5.51	81.68	24.21	7.04
45 - 49					11.22	2.41	20.94	2.14	32.08	6.29	88.84	28.40	10.16
50 – 54					13.89	4.33	24.20	5.74	30.78	8.04	93.26	29.58	12.29
<b>55–59</b>				• •	12.54	1.23	22.91	8.15	27.82	8.92	94.05	33.33	10.88
60-64		٠.			9.61	.71	20.74	2.68	20.58	3.09	96.32	36.17	7.72
<b>65–69</b>				• •	9.15	3.48	15.86	1.13	16.72	1.57	89.47	24.32	5.27
7074		• •	• •		9.97	4.29	22.78	.11	16.87	<b> 2.16</b>	93.55	39.13	5.42
75 – 79		• •	• •	• •	12.61	1.45	20.04	6.07	19.88	3.72	77.78	33.33	6.69
80–84		• •	• •	• •	9.48	9.14	6.83	6.81	25.63	-2.09	100.00	-14.29	7.25
85–89		• •		• •	3.13	.87	3.17	- 17.87	13.04	2.24		~ 33.33	-2.11
90 - 94		• •	• •		- 13.95	3.32	12.38	- 16.76	39.39	15.00			5.16
95-99		• •			1.05	-17.50	-14.29	- 14.29	25.00	23.08	• •		4.65
100 and	over	• •	• •	• •	11.11	-20.00	.00	.00	••	100.00	•••	••	5.26
ALL	Ages				4.17	<b></b> .33	8.78	1.51	14.54	2.08	65.20	15.75	3.84

Note. — denotes excess of females over males.

For the Commonwealth as a whole, it will be seen that the masculinity of the population varies with age in a remarkably regular manner, diminishing consistently from the earliest age to a minimum of .87 in the group 10–14. thence increasing continuously to a maximum of 12.29 in the group 50–54, thence diminishing to a further minimum of 5.27 in the group 65–69, followed by a further regular rise, fall, and subsequent rise.

A similar comparison of the Commonwealth masculinity at the Censuses of 1881, 1891 1901 and 1911 is furnished in the following table:—

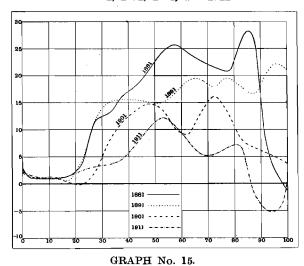
Masculinity of Population of Australia, 1881 to 1911. (Excess of Males over Females in each 100 of Population.)

	AGE L BIRTH			1881.	1891.	1901.	1911.	AGE LAST BIRTHDAY.	1881.	1891.	1901.	1911.
0-4 5-9 10-14 14-19 20-24 25-29 30-34 35-39				1.02 .90 .94 1.33 3.49 12.48 12.49 15.18	1.37 .98 1.20 .39 4.19 11.80 15.53 14.83	1.23 1.11 .98 .22 — .16 2.18 7.81 11.27	1.59 1.06 .87 1.49 2.47 3.16 3.49 4.36	55-59 60-64 65-69 70-74 75-79 80-84 85-89 90-94	25.55 23.99 22.50 22.23 20.04 26.35 28.96 3.17	16.23 19.45 19.31 17.72 19.89 17.80 12.31 25.42	10.22 8.81 13.19 16.63 13.25 7.71 6.90 5.31	10.88 7.72 5.27 5.42 6.69 7.25 — 2.11 — 5.16
40-44 45-49 50-54	••	• • • • • • • • • • • • • • • • • • • •	•••	17.89 20.73 24.50	16.10 14.76 15.27	13.29 14.74 13.83	7.04 10.16 12.29	95-99 100 & over	-5.26 20.00 	23.97 17.65 	6.21	-4.65 5.26

Note. — denotes excess of females over males,

The wave-like progression of masculinity with age, referred to above in the case of 1911, will be seen to have been in evidence also in the years 1881, 1891 and 1901, though usually less regular than in the case of 1911. Another feature of interest is the general tendency for the masculinity in any given age group above age 20, to diminish with successive Censuses, the only exception of importance being an increase in the age 3 20 to 29 in 1911, as compared with 1901, brought about mainly by the exceptional reduction of 1901 figures due to male migration at these ages during the period 1891 to 1901. For ages under 20 the masculinity has fluctuated

Masculinity of Commonwealth Population.—Censuses of 1881, 1891, 1901, and 1911.



somewhat, but has remained positive and small throughout, indicating a small excess of males in all cases. In this connexion it may be noted that the masculinity of the births registered for the years 1881, 1891, 1901 and 1911 were as follows:—1881, 2.80; 1891, 2.42; 1901, 2.01; 1911, 2.31. The figures given in the above table for ages under 20 consequently indicate that the excess of males over females in the case of births tends to be reduced by the higher rates of mortality existing amongst males, but that, under normal conditions, equality has not been reached by the ages at which the masculinity is again affected by the preponderance of male over female immigrants.

The accompanying Graph (No. 15) furnishes a representation of the variations in the masculinity of the population of of the Commonwealth at successive ages, at each of the Censnses of 1881 to 1911.

- 9. Average Age.—For many purposes it is of value to know not only the number of persons at each age, but also, the average age of each sex or of the whole community. There are two kinds of average frequently employed in this class of statistics, viz.:—
- (i.) The mean age, obtained by totalling the ages of all the population, male, female, or combined, and dividing by the number of each sex, or of both combined, as the case may be.
- (ii.) The median age, obtained by ascertaining that age for either sex, or for both combined, which is so situated that there are as many persons above it as there are below it.

In the case of the mean age, it is clear that since, in the Census returns, all persons are shewn as at their age last birthday, the totalling of the recorded ages and the division by the number of persons will understate the true mean age by approximately  $\frac{1}{2}$ , since on the average approximately half a year has elapsed since the last birthday.

In computing the average ages for the purposes of this section, use has been made of the smoothed results, as these are believed to represent the position with greater accuracy than the original data. The difference in average between crude data and adjusted results will, however, be insignificant. In the actual work of computing the mean age, use has been made of an interesting property of Tables 12, 13, and 14 of Part I. (Ages) of the Detailed Census Tables (See Volume II., pp. 22-27). These tables shew for each age the number at and above that age. By totalling these results and dividing by the total population the mean age next birthday is obtained, the subtraction of  $\frac{1}{2}$  from which gives approximately the true mean age. Computed on this basis, the mean age for each sex, and for both combined, for each State and Territory, is as follows:—

Mean Age of Population at Census of 3rd April, 1911.

_		MEAN AGE.	•		ı	MEAN AGE.	
STATE OR TERRITORY.	Males.	Females.	Persons.	STATE OR TERRITORY.	Males.	Females.	Persons
TATES-				Territories—			
New South Wales	27.46	26.17	26.84	Northern Terr.	41.34	21.74	37.93
Victoria Queensland South Australia	$28.11 \\ 27.48 \\ 27.43$	28.19 24.88 27.31	$28.15 \\ 26.29 \\ 27.37$	Federal Terr.	29.32	24.69	27.37
Western Australia Tasmania	28.28 26.33	24.79 25.98	26.79 26.16	C'WEALTH	27.67	26.65	27.18

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For the Commonwealth as a whole, the mean age of males exceeded that of females by almost exactly one year, whilst in Victoria the mean age of females was slightly in excess of that of males. Apart from the Territories, where the numbers involved are very small, the highest mean age for males occurred in Western Australia, and the lowest in Tasmania, the former being due largely to heavy adult male immigration, the latter to adult male emigration, combined with a comparatively high birth rate. Similarly, apart from the Territories, the highest mean age for females occurred in Victoria, the lowest in Western Australia. Amongst the States, the greatest deviation between mean male and mean female ages (3.49 years) occurred in the case of Western Australia, the least (.08 years) in Victoria.

The following table gives particulars relative to median ages for the same date:—

	ME	DIAN AGE.			М	edian Age.	
STATE OR TERRITORY.	Males.	Females.	Persons.	STATE OR TERRITORY.	Males.	Females.	Persons.
STATES— New South Wales Victoria Queensland South Australia	24.41 24.51 24.44 24.05	23.10 24.89 21.35 23.82	23.77 24.71 22.98 23.93	TERRITORIES— Northern Terr. Federal Terr.	44.51 25.89	18.69 19.20	41.73 23.19
Western Australia Tasmania	$28.03 \\ 22.50$	22.78 22.22	$25.94 \\ 22.36$	C'WEALTH	24.61	23.39	24.01

Median Age of Population at Census of 3rd April, 1911.

In all cases, except those of the Northern Territory Males and Persons, the median age was less than the mean age, the difference in the case of the Commonwealth as a whole being 3.06 years for males, 3.26 years for females, and 3.17 years for persons. The male median age for the Commonwealth exceeded the female by 1.22 years, as compared with a corresponding excess of 1.02 years in the case of mean ages.

A similar computation for the Commonwealth as a whole for the Censuses of 1881, 1891, 1901 and 1911, furnishes the following mean and median ages:—

				MEAN AGES.		MEDIAN AGES.			
YEAR OF	YEAR OF CENSUS.  Males.		Males.	Females.	Persons.	Males.	Females.	Persons.	
1881 1891 1901			25.43 25.54 26.66 27.67	22.49 23.29 24.97 26.65	24.08 24.50 25.86 27.18	21.74 23.10 23.62 24.61	18.42 20.08 21.45 23.39	20.08 21.65 22.53 24.01	

Commonwealth Mean and Median Ages, 1881 to 1911.

It will be seen from this table that the mean age of the Australian population increased by 3.10 years, and the median age by 3.93 years in the 30 years between the Census of 1881 and that of 1911. During the period mentioned, the male mean age increased by 2.24 years, and the female mean age by 4.16 years, while the male median age increased by 2.87 years, and the female median age by 4.97 years.

10. Full Age.—One of the most important divisions of population according to age is that which distinguishes between the population under 21 years of age, and that aged 21 years and over.

The following table gives for each of the States and Territories of the Commonwealth at the Census of 3rd April, 1911, the number of persons of each sex and of the two sexes combined who were aged 21 and over, and in each case the percentage on the corresponding total for all ages.

Adult Population, 3rd April, 1911.

STATE OR		ED 21 YEARS PWARDS.		ED 21 YEARS	Persons Aged 21 Years And Upwards.		
TERRITORY.	Number.	Percentage on Total Males of all Ages.	Number.	Percentage on Total Females of all Ages.	Number.	Percentage on Total Persons of all Ages.	
STATES		%		%	1	%	
New South Wales	489,148	57.03	429,736	54.46	918,884	55.80	
Victoria	371,091	56.60	380,300	57.62	751,391	57.12	
Queensland	188,276	57.14	140,277	50.77	328,553	54.23	
South Australia	116,974	56.41	112,502	55.92	229,476	56.17	
Western Australia	102,469	63.42	64,121	53.19	166,590	59.05	
Tasmania	51,505	52.78	49,121	52.47	100,626	52.63	
TERRITORIES							
Northern Territory	2,381	87.09	254	44.10	2,635	79.61	
Federal Territory	595	59.98	335	46.40	930	54.26	
Commonwealth	1,322,439	57.17	1,176,646	54.93	2,499,085	56,10	

Leaving the Territories out of account, Western Australia shewed the highest percentage of adult males, and Tasmania the lowest, while Victoria had the highest percentage of adult females, and Queensland the lowest.

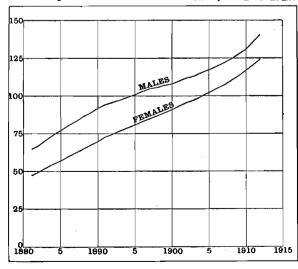
The following table furnishes corresponding results for the Commonwealth as a whole for the Censuses of 1881, 1891, 1901 and 1911:—

Commonwealth Adult Population, 1881 to 1911.

	YEAR OF CENSUS.				ED 21 YEARS OVER.		ED 21 YEARS OVER.	Persons Aged 21 Years and Over.		
YE	YEAR OF CENSUS.		Number.	Percentage on Total Males of all Ages.	Number,	Percentage on Total Females of all Ages.	Number.	Percentage on Total Persons of all Ages.		
1881			••	624,633	% 51.41	457,641	% 44.20	1,082,274	% 48.10	
1891			٠.	923,639	54.20	706,153	48.03	1,629,792	51.34	
1901				1,080,728	54.64	913,973	50.89	1,994,701	52.86	
1911				1,322,439	57.17	1,176,646	54.93	2,499,085	56.10	

A feature of this table worthy of special remark is the increasing proportion of adults which the figures disclose for succeeding Censuses, amounting to 5.76 per cent. in the case of males, and

Adult Population of the Commonwealth, 1881 to 1912.



GRAPH No. 16.

10.73 per cent. in the case of females, when the results for 1881 are compared with those for 1911. The proportion of adults is, throughout, less in the female than in the male population, but the difference in these proportions has continuously and rapidly diminished in the period under review from 7.21 per cent. in 1881, to 2.24 per cent. in 1911.

The accompanying graph (No. 16) furnishes a representation of the adult male and female population of the Commonwealth from 1881 to 1912. The base of each small square represents a duration of five years, and the height represents 250,000 persons.

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The following table, giving the estimated adult population, and mean population for each of the years 1881 to 1912, has been computed on the assumption that the adult percentage for each sex exhibited a linear progression between the successive Censuses, and that the percentage for the Census of 3rd April, 1911, held good for the years 1911 and 1912:—

Estimated Adult Population of Australia, 1881-1912.

	Ye.	A.R.			ADULT POPU Blst DECEMBI		Estimated	ADULT MEAN FOR YEAR.	Population
	114			Males.	Females.	Persons.	Males.	Females.	Persons.
		~							
881				643,700	471,400	1,115,100	631,000	462,200	1,093,200
882				669,400	492,800	1,162,200	656,600	482,100	1,138,700
883	• •			708,300	519,600	1,227,900	688,800	506,200	1,195,000
884	• •		• • •	740,700	544,800	1,285,500	724,400	532,200	1,256,600
885	• •		• • •	770,100	567,900	1,338,000	755,400	556,300	1,311,700
886	• •			801,000	592,600	1,393,600	785,600	580,200	1,365,800
887		• •		830,900	618,600	1,449,500	815,900	605,600	1,421,500
888	• •			862,800	646,700	1,509,500	846,800	632,600	1,479,400
889		• •	- ::	888,100	672,100	1,560,200	875,400	659,400	1,534,800
890				916,300	699,100	1,615,400	902,200	685,600	1,587,800
891		• •		941,800	725,800	1,667,600	929,600	712,600	1,642,200
892	• •	• •		959,000	746,900	1,705,900	950,400	736,300	1,686,700
893				973,300	766,500	1,739,800	966,100	756,600	1,722,700
894			- : :	991,700	786,900	1,778,600	982,500	776,600	1,759,100
895			- : :	1,009,600	808,000	1,817,600	1,000,700	797,400	1,798,100
896				1,027,600	827,500	1,855,100	1,018,600	817,800	1,836,400
897	• •			1,045,000	849,500	1,894,500	1,036,300	838,500	1,874,800
898		• •		1,056,800	867,800	1,924,600	1,050,900	858,600	1,909,500
899	• •			1,069,400	887,800	1,957,200	1,063,100	877,800	1,940,900
900	•••			1,080,000	908,800	1,988,800	1,074,700	898,300	1,973,000
901	•••	• •		1,099,300	931,800	2,031,100	1,087,000	919,700	2,006,700
902	• •			1,117,100	953,200	2,070,300	1,107,600	941,900	2,049,500
903		• •		1,131,700	973,200	2,104,900	1,123,300	962,800	2,086,100
904		• •		1,152,200	996,400	2,148,600	1,141,100	984,200	2,125,300
905		• •		1,172,700	1.020,700	2,193,400	1,161,700	1,008,000	2,169,700
906	• •			1,193,000	1,045,500	2,238,500	1,182,300	1,032,600	2,214,900
907	• • •	• •		1,217,200	1,073,100	2,290,300	1,204,100	1,058,700	2,262,800
908	• •	• •	- : :	1,241,800	1,101,100	2,342,900	1,228,700	1,086,400	2,315,100
909	• •	• • •	- ::	1,274,800	1,133,000	2,407,800	1,257,100	1,116,200	2,373,300
910	• •	• •	- ::	1,311,400	1,167,200	2,478,600	1,291,700	1,149,000	2,440,700
911	• •		- ::	1,359,500	1,203,400	2,562,900	1,334,100	1,184,700	2,518,800
912	• •	• •	- ::	1,410,400	1,244,900	2,655,300	1.383,700	1,221,900	2,605,600

11. Natural Age Groups.—An interesting view of the distribution of the population of Australia, and of the increases at different stages from 1881 onwards, may be obtained by a classification into what have been termed "Natural Age Groups." For the purposes of the present report these groups have been taken as follows:—Infancy (Ages 0 and 1), Childhood (Ages 2 to 13 inclusive), Adolescence (Ages 14 to 20 inclusive), Early Adult Life (Ages 21 to 44 inclusive), Mature Age (Ages 45 to 64 inclusive), Old Age (65 and over). In each case the ages here quoted are the ages last birthday.

Classified in this manner, the adjusted particulars for the four Censuses, 1881 to 1911, are as follows:—

Population of the Commonwealth of Australia, 1881 to 1911.

		·				M.	ALES.			Fem	ALES.	-
	AGE LAST BIRTHDAY.			PERIOD OF LIFE.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	Census of 1881.		Census of 1901.	
0.1				Infancy	66,240	94,500	90 000	113,407	64,800	91,750	87.900	109,383
$0-1 \\ 2-13$	• •	• •	• •	Childhood	349 320	466 250	539.150	556.347	342,880			
14-20	• •		• •	Adolescence	174.720	219.650	268,050	320,842	169,960	216,550	266,900	311,378
21-44	• • •		• • • • • • • • • • • • • • • • • • • •	Early Adult	1.2,.20		_00,000	0	,	'		
21-71	• •	•••	• •	Life	410,440	646,350	740,400	855,059	323,840	507,800	650,600	789,820
45-64				Mature Age		222,850		366,980	111,920	161,100	198,600	296,79
65 and	over	••		Old Age	34,433	54,439	85,278	100,400	21,881	37,253	64,773	90,029
		TOTAL	••		1214913	1704039	1977928	2313035	1035281	1470353	1795873	214197

The percentage of the total population included in each of the natural age groups shewn in the above table is as follows, the percentages being given for each sex separately:—

Percentage of Commonwealth Population of each Sex in each Natural Age Group, 1881 to 1911.

						M	ALES.			FEM	ALES.	
		LAST		PERIOD OF LIFE.	Census of 1881.	Census of 1891.		Census of 1911.	Census of 1881.	Census of 1891.	Census of 1901	Censue of 1911
	7, 1,-				%	0/	0/	0/	0/	0/	01	0.0
0-1				Infancy	5.45	% 5.55	% 4.55	<b>4.90</b>	6.26	% 6.24	% 4.89	% 5.11
2-13		• •		Childhood	28.75	27.36	27.26	24.05	33.12	31.01	29.35	25.42
14-20				Adolescence	14.38	12.89	13.55	13.87	16.42	14.73		
21-44	, ,	• • •	• • •	Early Adult	14.00	12.05	10.00	15.67	10.42	14.73	14.86	14.54
		• •	• • •	Life	33.78	37.93	37.43	36.97	31.28	34.53	36.23	0.00
45 - 65			٠.	Mature Age	14.80	13.08	12.90	15.87	10.81	10.96	11.06	36.87
65 and o			, .	Old Age	2.84	3.19	4.31	4.34	2.11	2.53	3.61	13.86 4.20
		TOTAL			100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

A comparison of the percentages for 1911 with those for 1881 discloses the fact that there has been a heavy proportionate reduction in the numbers in the periods of "infancy," "childhood," and "adolescence," and a corresponding increase in the periods of "early adult life," "mature age," and "old age." These variations are more marked in the case of females than in that of males.

The following table furnishes similar particulars for males in the several States and Territories of the Commonwealth for the Census of 3rd April, 1911:—

Males in Natural Age Groups, 3rd April, 1911.

Age Last Birthday.	PERIOD OF LIFE.	STATES.							TERRITORIES.	
		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH.

#### NUMBER.

0-1 2-13 14-20 21-44 45-64 65 and over	••	Infancy Childhood Adolescence Early Adult Life Mature Age Old Age	118,725 318,275	158,780 94,940 230,820 106,880	79,190 46,060 122,940 52,100	49,968 30,078 75,432 32,280	34,952 16,744 73,264 25,284	26,745	33 201 119 1,053 1,217	35 211 151 374 170 51	113,407 556,347 320,842 855,059 366,980 100,400
	TOTAL	ALL AGES	857,698	655,591			161,565		2,734		2313035

# PERCENTAGE ON TOTAL, ALL AGES.

$0-1 \\ 2-13 \\ 14-20 \\ 21-44$	•••		Infancy Childhood Adolescence Early Adult		4.70 24.22 14.48	4.85 24.03 13.98	4.98 24.10 14.50	$\begin{array}{c} \% \\ 4.58 \\ 21.63 \\ 10.36 \end{array}$	5.45 27.40 14.37	7.35 4.35	3.53 $21.27$ $15.22$	4.90 24.05 13.87
45-64 65 and			Life Mature Age Old Age	37.11	35.21 16.30 5.09	37.31 15.81 4.02	36.38 15.57 4.47	45.35 15.65 2.43	33.71 15.09 3.98	38.52 44.51 4.06	37.70 17.14 5.14	36.97 15.87 4.34
		TOTAL	ALL AGES	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Corresponding details for females are given in the succeeding table:—

Females in Natural Age Groups, 3rd April, 1911.

Age Last		Period			S	FATES.			TERRIT	rories.	
Birthda		of Life.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
				N	UMBER	y.	'				
0-1		Infancy	42,175		15,360		7,232	5,076	31	43	109,383
2-13		Childhood	202,950		76,960		34,144	25,671	197	221	544,563
l <b>4</b> –20	• •	Adolescence	114,175	94,700	43,710	29,772	15,052	13,752	94	123	311,378
21–44	• •	Early Adult	204.075	044 000	07.010	73,410	47,660	32,277	199	215	789,820
15-64		Life Mature Age	294,075 105,500					12,825	49	89	296,79
15–64 35 and over	• •	Old Age	30,161			9,650		4,019	6	31	90,02
	TOTAL	ALL AGES	789,036	659,960	276,307	201,200	120,549	93,620	576	722	214197
							LL AGE				]
0.1		Infancy	5.35	4.47	% 5.56	4.95	6.00	$\substack{ \% \\ 5.42}$	$\begin{array}{c} 8\\ 5.38 \end{array}$	5.95	$\begin{array}{c c} & \% \\ 5.11 \end{array}$
$\begin{array}{ccc} 0-1 & \dots \\ 2-13 & \dots \end{array}$	• •	Childhood	25.72	23.56	27.85	24.33	28.32	$\begin{array}{c} 3.42 \\ 27.42 \end{array}$	34.20	30.61	25.42
$egin{array}{cccc} 2-13 & \dots \ 14-20 & \dots \end{array}$		Adolescence	14.47	14.35	15.82	14.80	12.48	14.69	16.32	17.04	14.54
21-44	• • •	Early Adult		11.00	10.02	11.00	12.10	-1.00		11101	11.01
	• • •	Life	37.27	36.98	35.44	36.49	39.54	34.48	34.55	29.78	36.87
15-64		Mature Age	13.37	15.46	11.99	14.63	11.39	13.70	8.51	12.33	13.86
55 and over	••	Old Age	3.82	5.18	3.34	4.80	2.27	4.29	1.04	4.29	4.20
	TOTAL	ALL AGES	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

12. School Age.—In all the States of the Commonwealth, ages are fixed within the limits of which children must be sent to school, except under certain special circumstances. In New South Wales, Victoria, Queensland, Western Australia, and Tasmania, this compulsory provision covers all children who have attained age 6, but are less than 14 years of age. In South Australia the corresponding limits of age are 7 and 13. The extension of the upper limit in the case of Queensland to age 14 took effect as from 1st July, 1912. At the date of the Census (3rd April, 1911) the Queensland upper limit was 12, that is to say, children who had reached age 12 were exempt from the compulsory provision.

The number of children at each of the ages last birthday from 6 to 13 inclusive at the date of the Census was as follows:—

Children of School Age, 3rd April, 1911.

				•	dren or								
	A	ge Las	iT.				STAT	ES.		100	TERRIT	ORIES.	
		(RTHDA			N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH
					·		MALES						
6					17,875	13,380	6,620	4,182	3,124	2,325	20	17	47,543
7					17,000	13,180	6,500	4,080	3,020	2,268	19	17	46,084
8					16,250	13,000	6,400	3,990	2,900	2,208	18	17	44,783
9					15,700		6,340	3,930	2,780	2,145	17	18	43,770
10			• •		15,425		6,300	3,894	2,644	2,073	15	18	43,049
11	• •				15,500		6,280	3,882	2,492	2,007	13	19	42,753
12					15,725		6,290	3,894	2,328	1,959	12	20	42,748
13	• •	• •	• •	• •	15,975	12,580	6,310	3,954	2,180	1,959	12	20	42,990
	TOTAL	••			129,450	102,740	51,040	31,806	21,468	16,944	126	146	353,720
					1	<u> </u>	FEMALI	ES.		'			<u> </u>
_					1	10.040	0.100		0.000	2 222			1.0.00
6	• •	• •	• •	• •	17,450	13,040	6,420	4,116	3,028	2,208	19	17	46,298
7	• •	• •	• •	• •	16,800	12,860	6,320	4,008	2,924	2,163	19	17	45,111
8	• •	• •	• •	• •	16,250	12,680	6,250	3,918	2,804	2,118	18	17	44,055
9	• •	• •	• •	• •	15,875	12,520	6,190	3,852	2,692	2,073	16	18	43,236
10	• •	• •	• •	• •	15,625	12,420	6,160	3,810	2,584	2,022	15	18	42,654
11	• •	• •	• •	• •	15,400	12,400	6,140	3,804	2,480	1,965	14	19	42,222
$\frac{12}{13}$	• •	• •	• •	• •	15,325 15,325	12,440 12,580	6,140 $6,160$	$\frac{3,822}{3,900}$	$2,340 \\ 2,180$	$\frac{1,902}{1,896}$	$\begin{array}{c} 12 \\ 11 \end{array}$	20 20	42,001
13	• •	• •	• •	• •	10,520	12,000	0,100	3,900	4,100	1,090	11		42,072
	TOTAL	• •	• •		128,050	100,940	49,780	31,230	21,032	16,347	124	146	347,649

Children	of	School	Age.	3rd	April.	1911—continued.

							State	s.			TERRIT	TORIES.	•
	AGE LAST BIRTHDAY.				N.S.W.	Vic.	Q'land.	S. A.	W.A.	Tas.	N.T.	F.T.	C'wlth
				-			тота	L.		'			
6	•• *				35,325			8,298	6,152	4,533	39	34	93,841
7 8	• •	• •	• •	• •	33,800	26,040		8,088	5,944	4,431	38	34	91,195
9	• •	• •	• •	• •	32,500 31,575	$25,680 \\ 25,360$		$7,908 \\ 7,782$	$\begin{array}{c} 5,704 \\ 5,472 \end{array}$	$\frac{4,326}{4,218}$	36 33	34 36	88,838
1ŏ	• •			• •	31,050	25,300 25,100		7,704	5,228	4,095	30	36	87,006 85,703
11	••	• •		• • •	30,900	24,960		7,686	4.972	3,972	27	38	84,975
12					31,050	24,960		7,716	4,668	3,861	24	40	84,749
13	• •	• •	• •	• •	31,300	25,160		7,854	4,360	3,855	23	40	85,062
	TOTAL]				257,500	203,680	100,820	63,036	42,500	33,291	250	292	701,369

The figures here given are the adjusted results for the Commonwealth and for the several States and Territories.

A comparative statement shewing the number of children above 6 and under 14 in the Commonwealth at each of the last four Censuses is furnished in the following table:—

Children of School Age, Commonwealth of Australia, 1881 to 1911.

					Nu	MBER.		-	Increase.*	
A	GE LAST	BIRTH	DAY.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	From 1881 to 1891.	From 1891 to 1901.	From 1901 to 1911.
		40				MALES.		·	<u> </u>	
6				29,720	40,750	45 900	47,543	11,030	5,050	1,743
7	• •	• •	• •			45,800				
8	••	• •	• •	29,200	39,350	46,400	46,084	10,150	7,050	-316 $-2,067$
9	• •	• •	• •	28,720	37,950	46,850	44,783	9,230	8,900 10,200	
10	• •	• •	• •	28,240	36,650	46,850	43,770	8,410		3,080
	• •	• •	• •	27,800	35,550	46,300	43,049	7,750	10,750	-3,251
1	• •	• •	• •	27,360	34,700	45,100	42,753	7,340	10,400	2,347
12	• •	• •	• •	26,960	33,850	43,700	42,748	6,890	9,850	952
3	• •	• •	• •	26,560	33,000	42,400	42,990	6,440	9,400	590
	TOTAL	• •	••	224,560	291,800	363,400	353,720	67,240	71,600	9,680
	·					FEMALE	S.			
6				29,200	39,900	44,750	46,298	10,700	4,850	1,548
7	• •			28,680	38,500	45,400	45,111	9,820	6,900	289
8	• •		• •	28,200	37,250	45,900	44,055	9,050	8,650	-1,845
9	• •			27,720	36,100	45.850	43,236	8,380	9,750	2,614
Ō	• • •			27,280	35,000	45,100	42,654	7,720	10,100	2,446
i	• •	•••		26,840	33,950	44,050	42,222	7,110	10,100	-1,828
2	••	• • •	• •	26,440	32,950	42,850	42,001	6,510	9,900	849
3	••	• • •	• • •	26,080 .	32,050	41,750	42,072	5,970	9,700	322
	TOTAL	••	••	220,440	285,700	355,650	347,649	65,260	69,950	8,001
	_			<u>,                                      </u>		TOTAI	4.	<u> </u>		
6		_		58,920	80,650	90,550	93,841	21,730	9,900	3,291
7	• • •		• •	57,880	77,850	91,800	91,195	19,970	13,950	<b>—605</b>
8	• • •	• • •	• • •	56,920	75,200	92,750	88,838	18,280	17,550	<b>3</b> ,912
9	• •	• •	• •	55,960	72,750	92,700	87,006	16,790	19,950	-5,694
ŏ	• • •	• • •	• •	55,080	70,550	91,400	85,703	15,470	20,850	-5.697
1	• • •	• • •	• • •	54,200	68,650	89,150	84,975	14,450	20,500	<b>-4,175</b>
2	••	• •	• • •	53,400	66,800	86,550	84,749	13,400	19,750	-1,801
3	• • •	• • •	• • •	52,640	65,050	84,150	85,062	12,410	19,100	912
	TOTAL			445,000	577,500	719,050	701,369	132,500	141,550	-17,681

<sup>\* —</sup> Signifies decrease.

AGES.

The decreases shewn in the preceding table for the period from 1901 to 1911, in the ages 7 to 12 inclusive, resulted from the diminution in the number of births during the period 1898 to 1903 inclusive, as compared with those for the period 1888 to 1893. A comparison of the number of births in the several years of these two periods is as follows:—

Comparison of Births Registered in Aust
---

			•• ]	1888	1889	1890	1891	1892	1893
Births Registered	• •	••	•••	104,080	104,724	108,683	110,187	110,158	109,322
Period				1898	1899	1900	1901	1902	1903
Births Registered				98,845	100,638	102,221	102,945	102,776	98,443

It is evident from these figures that if it had not been for the marked improvement in the rates of infantile mortality during the later period, the decreases in the numbers at ages 7 to 12 would have been much greater than actually resulted. From 1904 onwards the number of births has increased rapidly, and the indications are that the numbers for all ages from 6 to 13 inclusive at the Census of 1921 will shew a large increase over those for 1911.

13. Supporting Age.—The male population may conveniently be divided in respect of age into three groups in relation to its breadwinning capabilities. The first group, that of Dependent Age, ranges from 0 to 14 inclusive, the second, that of Supporting Age, from 15 to 64 inclusive, and the final group of Old Age from 65 upwards. Details for the Commonwealth and for the several States and Territories as at the date of the Census are as follows:—

Australian Male Population, 3rd April, 1911.

					MALE	POPUL.	ATION.			
AGE LAST BIRTHDAY.	Period of Life.			Sta	TES.			TERRIT	cories.	
		n.s.w.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
			N	UMBER						
0-14 15-64 65 & over	Dependent Age Supporting Age Old Age	266,050 555,100 36,548	419,760	101,520 214,750 13,236	133,734	113,196	34,041 59,670 3,880	247 2,376 111	267 674 51	1499260
TOTAL		857,698	655,591	329,506	207,358	161,565	97,591	2,734	992	231303
	,		PEI	RCENTA	GE.					
0-14 15-64 65 & over	Dependent Age Supporting Age Old Age	$ \begin{array}{c} \% \\ 31.02 \\ 64.72 \\ 4.26 \end{array} $	30.88 64.03 5.09	30.81 65.17 4.02	% 31.04 64.49 4.47	27.51 $70.06$ $2.43$	% 34.88 61.14 3.98	9.03 86.91 4.06	26.92 67.94 5.14	30.84 64.82 4.34
TOTAL		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Amongst the States, the highest proportion of "supporting age" was 70.06 per cent. in the case of Western Australia, and the lowest 61.14 per cent. in the case of Tasmania. Similarly, for "dependent age," the highest proportion was 34.88 per cent. in Tasmania and the lowest 27.51 per cent., in Western Australia while for "old age" Victoria was highest with 5.09 per cent. and Western Australia lowest with 2.43 per cent.

Similar particulars for the Commonwealth for each of the last four Censuses are furnished in the following table:—

A 4 12	36-1-	D 1-41	1001	4- 1011	
Australian	MALE	Population.	TSST	to Tatt	

		MALE POPULATION.											
AGE LAST BIRTHDAY.	PERIOD OF LIFE.		Numb	ER.	Percentage.								
					Census of 1911.								
0-14 15-64 65 and over	Dependent Age Supporting Age Old Age		1056650	1222300	713,375 1499260 100,400	60.80	34.80 62.01 3.19	% 33.89 61.80 4.31	% 30.84 64.82 4.34				
TOTAL		1214913	1704039	1977928	2313035	100.00	100.00	100.00	100.00				

During the 30 years from 1881 to 1911, the proportion per cent: of male population in the "dependent age" group decreased by 5.52, while the proportion for "supporting age" increased by 4.02 and that for "old age" by 1.50. The diminution in the case of "dependent age" and the increase in the case of "old age" have each been continuous for the period, but the increase in the case of "supporting age" evidences a setback in the 1901 figures. This is mainly due to the male emigration arising from the financial crisis of 1893, and to the departure of troops for South Africa in 1899 and 1900.

•14. Childbearing Age.—With reference to the function of childbearing, a convenient division of the female population, according to age, is into three groups of Immature, Reproductive, and Sterile. The limits of these groups are not clearly defined, but in practice they may be taken as 0–14 for the Immature, 15–44 for the Reproductive, and 45 onwards for the Sterile. It is, of course, true that cases of reproduction are not infrequent beyond 44, and are even not unknown beyond 50, but the Australian experience for the four years, 1909–12, indicates that of 481,213 mothers, only 2,896, or 6 per thousand births, were aged 45 or upwards. Cases of birth under 15 also occur, but during the same period of four years only 92 were registered, or less than 1 in every 5,000 births. Details for the Commonwealth and for the several States and Territories as at the date of the Census are as follows:—

Australian Female Population, 3rd April, 1911.

				FEMA	ALE PO	PULATI	ON.			
AGE LAST BIRTHDAY.	Period of Life.		_	Sta	TES,	•		TERRE		
		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
			·	NUMBI	ER.					-
0-14 15-44 45 & upwards	Immature Reproductive Sterile	392,800	197,820 325,920 136,220	135,440	99,180	60,652		238 283 55	318	696,448 1058702 386,820
TOTAL		789,036	659,960	276,307	201,200	120,549	93,620	576	722	2141970
			P	ERCEN	TAGE,				<u> </u>	
0-14 15-44 45 & over	Immature Reproductive Sterile	33.03 49.78 17.19	% 29.97 49.39 20.64	% 35.65 49.02 15.33	% 31.28 49.29 19.43	% 36.03 50.31 13.66	% 34.89 47.12 17.99	% 41.32 49.13 9.55	$egin{array}{c} \% \\ 39.34 \\ 44.04 \\ 16.62 \\ \end{array}$	32.51 49.43 18.06
Total		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Amongst the States the highest proportion of "reproductive age" was 50.31 per cent. in Western Australia and the lowest 47.12 per cent. in Tasmania. Similarly, for the "immature age," the highest proportion was 36.03 per cent. in Western Australia and 29.97 per cent. in Victoria, while for the "sterile age," the highest proportion was 20.64 per cent. in Victoria and the lowest 13.66 per cent. in Western Australia.

Similar particulars for the Commonwealth for each of the last four Censuses are furnished in the following table:-

# Australian Female Population, 1881 to 1911.

		İ		FEM	ALE PO	OPULAT	rion.			
AGE.	PERIOD OF LIFE.		Nume	ER.		PERCENTAGE.				
		Cens of 18	Census 81. of 1891	Census of 1901.	Census of 1911.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911	
0-14 15-44 45 and over	Immature Reproductive Sterile	468,	360 579,000 120 693,000 801 198,353	876,800	1058702	45.22	39.38 47.13 13.49	36.51 48.82 14.67	32.51 49.43 18.06	
Тота	ь	1035	281 1470353	1795873	2141970	100.00	100.00	100.00	100.00	

During the 30 years from 1881 to 1911, the proportion per cent. of female population who were of "immature age" declined by 9.35, while the proportion of "reproductive age" increased by 4.21, and the proportion of sterile age by 5.14. The increases and decreases have been continuous throughout.

- 15. Military Age.—In accordance with Section 125 of the Defence Act 1903 and subsequent amendments, all male inhabitants of Australia (excepting those exempted under the Act) who have resided therein for 6 months, and are British subjects, are liable to be trained as follows:-
  - (i.) From 12 to 14 years of age as Junior Cadets.
  - 14 to 18 years of age as Senior Cadets.
  - 18 to 26 years of age in the Citizen Forces.

The number of males in each of these age groups in the Commonwealth, and each of its component States and Territories at the 3rd April, 1911, was as follows:-

			A	ustrali	an Male	Populati	ion of T	aining	Age, 3rd	April, 1	911.		
						I	MALE P	OPULA	TION, 1	2-25.			
		E LAST				•	Sta	res.			TERRIT		
	Dii	vinomi.			N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
	-					NU	UMBER.						
12–13 14–17 18–25		••			31,700 66,400 139,350	53,920	12,600 25,800 53,880	7,848 16,848 34,746	4,508 8,812 23,156	3,918 8,097 14,511	24 56 215		85,738 180,019 367,204
	TAL				237,450	180,200	92,280	59,442	36,476	26,526	295	292	632,96
•				· P	ERCEN'	TAGE O	N TOT	AL MAI	E POP	ULAT10	N.		
12-13 14-17 18-25	••	•••			3.69 $7.74$ $16.25$	3.83 8.23 15.43	3.83 7.83 16.35	3.78 8.13 16.76	2.79 5.46 14.33	4.01 8.30 14.87	.88 2.05 7.86	4.03 8.67 16.74	% 3.71 7.78 15.88
То	tal				27.68	27.49	28.01	28.67	22.58	27.18	10.79	29.44	27.37

Under Section 59 of the same Act, all male inhabitants of Australia (excepting those who are exempt from service) who have resided therein for 6 months, and are British subjects, and are between the ages of 18 and 60 years, are in time of war liable to serve in the Citizen Forces. The total number of males between the ages of 18 and 60 at the date of the Census (i.e., at ages 18 to 59 inclusive, last birthday), and the percentage of total male population which they represent are as follows:-

Australian M	ale	Population	of	Military	Service	Age.	3rd	April	1911.
--------------	-----	------------	----	----------	---------	------	-----	-------	-------

			MALE 1	POPULA	ATION, 1	18–59.			
AGE LAST BIRTHDAY.			Sta	TES.	_		TERRE	rories.	
	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
Number	485,100	364,760	187,790	115,998	103,732	51,498	2,173	577	1311628
Percentage on Total Males	56.56	55.64	56.99	55.94	64.20	52.77	79.48	58.17	56.71

From the preceding tables it will be seen that at the date of the Census, 27.37 per cent. of the male population were of training age, while 56.71 per cent. were of such age as to be liable to serve in the Citizen Forces in the event of war. Particulars concerning the number of these that for various reasons would be exempt are not available.

16. Metropolitan Population in Ages.—The following table gives the number of persons in each age group resident in the several metropolitan areas of the Commonwealth, and the aggregates for these areas combined. In compiling these results persons of unspecified age have been distributed pro rata over the several age groups.

Metropolitan Population According to Age (Sexes Combined) 3rd April, 1911.

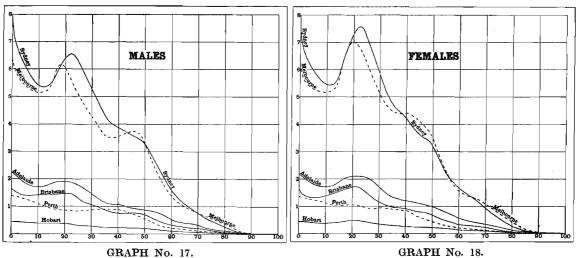
Age	Last	Віктн	DAY.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metropol- itan Areas
0-4				67.854	57,237	14,828	20,381	13,238	4,347	177,885
5-9			• •	56,983	52,216	13,533	17.599	11,973	3,858	156,162
10-14				54,175	51,809	14,178	17,404	10,355	3,735	151,656
15–19				62,418	62,044	15,338	19,473	9,654	4,256	173,183
20-24				69,850	62,156	15,560	19,851	9,318	4,066	180,801
25-29				62,325	52,436	12,532	17,928	8,765	. 3,507	157,493
30-34				51,336	44,105	10,393	14,425	8,955	2,785	131,999
35-39				42,861	39,548	8,766	11,822	8,950	2,417	114,364
40-44			٠.	38,340	39,884	8,046	10,976	7,990	2,364	107,600
45-49				35,176	38,062	7,560	9,816	6,030	2,197	98,841
50 – 54				29,154	29,350	5,939	8,693	4,136	1,840	79,112
55 - 59				19,897	18,142	4,054	6,745	2,483	1,347	52,668
60 – 64				14,613	13,389	2,989	4,836	1,880	1,029	38,736
65–69				10,864	10,782	2,509	3,946	1,427	858	30,386
7074				7,080	8,186	1,800	2,716	886	604	21,272
75–79				4,168	5,599	917	1,657	473	408	13,222
80–84				1,726	2,895	398	922	193	210	6,344
85 – 89		••		522	881	112	352	69	81	2,017
90 – 94		• •	• •	135	218	26	82	15	23	499
95 – 99		• •	• •	20	28	• •	20	1	4	73
100 an	d over	٠	• •	6	4	2	2	1	1	16
	Total			629,503	588,971	139,480	189,646	106,792	39,937	1,694,329

The general trend of the metropolitan population curve will be seen to be a decline from the earliest age to the age group 10–14, a rise thence to the group 20–24, and a subsequent decline throughout. Sydney, Melbourne, Adelaide and the total metropolitan areas are strictly in accord with this trend, while Brisbane and Hobart vary but slightly from it. Perth, on the other hand, exhibits a fairly complete decline in numbers throughout, the only exception being a slight fluctuation at ages 30–34 and 35–39. In Sydney, Melbourne, Brisbane and the total metropolitan areas, the figures for the group 20–24 exceed those for 0–4, as do also those for 15–19 in Melbourne and Brisbane. In Adelaide, Perth and Hobart, the age group 0–4 contains a larger number than any other group.

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The accompanying graphs, Nos. 17 and 18, furnish a representation of the male and female population of each metropolitan area at the Census of 1911. For numerical details see Volume II., pp. 38-41.

MAMES. Metropolitan Population.—Census 1911. FEMALES.



The proportion per cent. of the total for each metropolitan area, represented by the number in each age group is shewn in the following table:—

Proportion per cent. in each Quinquennial Age Group (Sexes Combined) 3rd April, 1911.

Age	Last	Віктн	DAY.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metropol- itan Areas
				.%_	%	%	%	%,,		%
0-4	• •	• •	• •	10.78	9.72	10.63	10.75	12.40	10.89	10.50
5-9	• •	• •	• •	9.05	8.87	9.70	9.28	11.21	9.66	9.22
10-14	• •	• •	• •	8.61	8.80	10.16	9.18	9.70	9.35	8.95
15-19	• •	• •	• •	9.92	10.54	11.00	10.27	9.04	10.66	10.22
20-24	• •	• •	• •	11.10	10.55	11.16	10.47	8.73	10.18	10.67
25-29	• •	• •		9.90	8.90	8.98	9.45	8.21	8.78	9.30
30–34	• •	• •	• •	8.16	7.49	7.45	7.61	8.39	6.97	7.79
35–39	• •	• •		6.81	6.72	6.28	6.23	8.38	6.05	6.75
40–44				6.09	6.77	5.77	5.79	7.48	5.92	6.35
<b>45–4</b> 9		• •		5.59	6.46	5.42	5.18	5.65	5.51	5.83
50 – 54				4.63	4.98	4.26	4.58	3.87	4.61	4.67
55 <b>–5</b> 9				3.16	3.08	2.91	3.56	2.32	3 <b>.3</b> 7	3.11
60-64				2.32	2,27	2.14	2.55	1.76	2.58	2.29
65–69				1.73	1.83	1.80	2.08	1.34	2.15	1.79
70-74				1.12	1.39	1.29	1.43	.83	1.51	1.25
75–79				.66	.95	.66	.87	.44	1.02	.78
80-84		٠.		.27	.49	.29	.49	.18	.53	.37
85–89				.08	.15	.08	.18	.06	.20	.12
90 – 94				٦	1					
95-99				.02	.04	.02 -	.05	.01	.06	.04
100 an	d over		• •	J		.,-	.,			
	TOTAL			100.00	100.00	100.00	100.00	100.00	100.00	100.00

The proportions per cent. in the groups 0-14, 15-64 and 65 and over in the several metropolitan areas are as follows:—

Proportion per cent. (Sexes Combined) 3rd April, 1911.

AGE LAST I	Зіктн	DAY.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metropol- itan Areas.
0-14 15-64 65 and over			% 28.44 67.68 3.88	27.39 67.76 4.85	% 30.49 65.37 4.14	% 29.21 65.69 5.10	% 33.31 63.83 2.86	29.90 64.63 5.47	28.67 66.98 4.35
TOTAL			100.00	100.00	100.00	100.00	100.00	100.00	100.00

It thus appears that for the metropolitan areas as a whole,  $28\frac{3}{3}$  per cent. of the population were under 15, 67 per cent. were between 15 and 65, while  $4\frac{1}{3}$  were above 65 years of age. For the extra-metropolitan areas of the Commonwealth, the corresponding figures were as follows:—Under 15,  $33\frac{1}{2}$  per cent.; between 15 and 65,  $62\frac{1}{4}$  per cent.; above 65,  $4\frac{1}{4}$  per cent. It will be

seen that the extra-metropolitan population of the Commonwealth contains a much larger proportion of persons under 15, and a correspondingly smaller proportion between 15 and 65, than is the case with the metropolitan areas, the proportions of persons aged 65 and upwards differing but slightly.

The masculinity in age groups of the several metropolitan populations determined in accordance with the third method described on pp. 98, 99 ante, is given in the following table:—

Masculinity of Metropolitan Population. (Excess of Males over Females in each 100 of Population), 3rd April, 1911.

Age	Last	Віктні	DAY.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metropol- itan Areas.
0-4			٠.	2,12	1.41	2.64	.36	1.30	1.96	1.73
5-9		• •	٠.	.51	.66	2.28	.96	.48	3.84	.84
10-14	• •	• •	• •	1.06	52	75	1.01	2,37	1.42	94
15-19	• •	• •	• •	<b>—4.72</b>	5.22	5.23	-3.79	<b></b> 7.17	7.75	-5.05
20-24		• •	• •	<b>7.06</b>	9.64	8,64	6.31	9.06	-17.66	-8.34
25-29	• •	• •	• •	6.54	-9.55	6.08	<b>— 7.89</b>	-4.28	12.92	<b> 7.68</b>
30-34	• •	• •	• •	4.62	-10.21	5.15	6.86	2.42	-12.89	6.80
35-39	• •	• •	• •	5.11	11.17	-5.86	7.66	1.47	10.63	<b>—</b> 7.13
40-44	• •	• •		2.41	<b>— 7.18</b>	6.79	8.20	5.33	-8.12	-4.65
45-49	• •	• •	• •	13	3.78	— .11	8.23	9.82	5.05	1.84
50-54	• •	• •	• •	3.33	<b>— 2.03</b>	1.94	4.20	11.36	<b>— 7.07</b>	.59
55-59		• •	• •	2.34	3.20	35	.37	2.38	10.32	54
60-64		• •	• •	5.50	10.08	3.45	<b>— 7.57</b>	1.06	-9.62	6.97
65-69		• •		9.87	16.53	8.89	3.55	— 1. <b>4</b> 7	— 17. <b>4</b> 8	11.15
70-74		• •	• •	8.47	15.71	2.67	9.20	4.29	19.21	-10.63
75–79		• •	• •	<b>— 7.97</b>	9.63	1.64	-13.58	10.36	20.59	8.44
80-84				9.85	6.94	7.54	12.58	19.17	-6.67	7.79
85–89		• •		20.31	11.24	17.86	-21.59	10.14	1.23	-14.53
90-94		• •		39.26	14.68	.00	26.83	33.33	21.74	19.44
95–99		• •	• •	30.00	<b>—</b> 50.00		50.00	100.00	50.00	36.99
100 an	d over		• •	66.67	50.00	.00	100.00	100.00	100.00	<b>— 50.00</b>
	ALL A	GES.		2.87	-5.61	3.03	4.48	31	- 7.42	-3.96

NOTE. — denotes excess of females over males.

It will be seen that in all the metropolitan areas there was a preponderance of females in the total population, and that in the total for the metropolitan areas this preponderance was in evidence at all ages except 0-9 and 50-54. The general characteristics of the variation of masculinity with age are very similar to those for the general population commented upon on page 99, the wavelike variation being strongly in evidence.

In the succeeding table, particulars are furnished relative to the proportion of the persons in each age group who were resident in the metropolitan areas of the several States and of the Commonwealth as a whole.

Proportion of Population in Metropolitan Areas (Sexes Combined), 3rd April, 1911.

Age	Last	Віктн	DAY.	Sydney and Suburbs	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metropol- itan Areas.
	_			% 33.71	%	%	%	%	%	%_
0-4				33.71	39.78	20.08	42.79	37.79	17.49	33.76
5-9				33.79	40.20	21.27	43.56	40.89	17.40	34.37
10 - 14				34.40	40.96	22,66	44.53	44.09	18.87	35.33
15-19				37.82	45.49	23.98	45.16	42.38	21.48	38.36
20 - 24				40.79	48.58	24.53	46.77	36.53	22,26	40.25
25 - 29				41.61	48.42	23.68	47.49	33.54	22.32	40.29
30-34				41.10	46.81	23.60	48.19	33.87	21.03	39.62
35 - 39				40.24	45.77	22.82	47.98	34.85	21.30	38.98
40 - 44				40.36	46.63	23.03	48.13	36.27	22.45	39.66
45 - 49				41.50	47.58	24.21	47.98	36.45	22.62	40.64
50 - 54				41.80	47.58	23.86	48.31	36.98	22.49	40.74
55-59				40.81	47.51	24.21	49.89	37.17	23.99	40.57
60-64				39.92	47.25	23.95	50.10	40.47	25.27	40.34
65 - 69				38.03	44.57	24.80	50.69	44.37	26.66	39.36
70-74				36.65	41.95	25.35	51.21	45.34	27.77	38.38
75 - 79				34.81	39.15	25,92	49.24	49.27	29.02	37.18
80 - 84				34.70	39.46	28.95	51.22	48.86	29.45	38.21
85 - 89				33.35	38.71	23.93	53.01	56.10	29.78	37.55
90 - 94				31.62	40.82	25.49	49.10	42.86	28.75	37.10
95 - 99				28.99	31.11		52.63	25.00	17.39	30.04
100 an	d ove	г		19.35	22.22	40.00	66.67	33.33	25.00	25.00
	Тотаі			38.23	44.77	23.02	46.42	37.85	20.89	38.03

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The general trend indicated by the figures for total metropolitan areas is that the proportion resident in such areas increases with age to the group 25–29, declining thence to group 35–39, rising thence to group 50–54, and declining thereafter throughout. This trend is also clearly marked in the cases of Sydney and Melbourne, but is less regular in most of the other capitals, while in the case of Adelaide the proportion increases with age throughout, except for some minor fluctuations.

It will be seen from the above that on the average, 38 per cent. of the population of the Commonwealth was resident in metropolitan areas, the percentage for ages between 15 and 75 being above this average, while for ages under 15 and above 75 the proportion was below this average, with the exception of age-group 80–84.

In Section 9 of the present Chapter, dealing with "Average Age," (p. 100) the mean and median ages of the populations of the several States and Territories of the Commonwealth are shewn. Similar particulars in respect of the various metropolitan areas are given in the following table:—

Metropolitan Mean and Median Ages, 3rd April, 1911.

	M	EAN AGE.		MEDIAN AGE.			
METROPOLITAN AREAS.	Males.	Females.	Persons.	Males.	Females.	Persons.	
700000000000000000000000000000000000000	years.	years.	years.	years.	years.	years.	
Sydney and Suburbs	27.69	28.06	27.88	25.09	25.41	25.26	
Melbourne and Suburbs	28.32	29.39	28.88	25.07	26.41	25.81	
Brisbane and Suburbs	26.92	27.37	27.15	23.46	24.03	23.77	
Adelaide and Suburbs	27.81	28.76	28.31	24.39	25.59	25.03	
Perth and Suburbs	26.81	25.93	26.37	25.15	23.71	24.37	
Hobart and Suburbs	27.50	29.04	28.33	23.57	25.38	24.61	
Total, Metropolitan .	27.79	28.44	28.13	24.84	25.56	25.22	

On comparing these figures with those given in Section 9, it will be seen that both for mean and median ages the averages for the metropolitan areas are higher than those for the Commonwealth as a whole. Thus, the metropolitan mean age for persons was 28.13, as compared with the Commonwealth mean age of 27.18, whilst the metropolitan median age for persons was 25.22, as compared with the Commonwealth median age of 24.01.

For the metropolitan areas, the mean age for persons exceeded the median age by 2.91 years, as compared with an excess for the Commonwealth as a whole of 3.17 years.

17. **State Subdivisions.**—In addition to the information specified in the preceding Section, relative to metropolitan Populations, particulars were tabulated for various subdivisions of the several States and Territories, and the majority of these are published in Part I. (Ages) of the Census Detailed Tables. (See Volume II., pp. 44-98.)

In all cases the number of persons of each sex and of the sexes combined under and over 21 years of age, is published for each Commonwealth Electoral Division, as well as for each State Electoral Province and Electoral District. In addition, details for each quinquennial age group, and for each single age under 5 is published in respect of Counties in New South Wales and Victoria, Census Districts in Queensland, Counties and Divisions in South Australia, Statistical Districts in Western Australia, Municipalities in Tasmania, and Counties in the Northern Territory.

## CHAPTER XI.

## BIRTHPLACES.

1. Form of Inquiry and Tabulation.—At the Census of the 3rd April, 1911, each person was asked to state on a "personal" card, the "Country or Australian State where born," and from the replies to this query, taken in conjunction with the other data furnished, the tables contained in Part II. (Birthplaces) of the Detailed Census Tables have been compiled. (See Volume II., pp. 105-385). As usual in such cases the replies given were frequently more minute than was required, the province, county, town, or even village of birth being supplied instead of the country, thus entailing extensive reference to atlases and gazetteers in the course of classification. For convenience of tabulation a scheme of classification of birthplaces was drawn up, comprising 75 items, and these items, with their allotted numbers, formed the basis for tabulation of birthplaces in all parts of the Report and Detailed Tables.

The scheme of classification was as follows:-

Birth-		Birth-	
place		place	_
No.		No.	
	Australasia—		Asia—continued—
	Commonwealth of Australia-	40	Java
1	New South Wales	41	Philippine Islands
f 2	Victoria	42	Syria
3	Queensland	43	Other Asiatic Countries
4	South Australia	10	Conce Holder Countries
5	Western Australia	100	Africa—
6	Tasmania	44	Cape of Good Hope
7	Northern Territory	45	Mauritius
8	Australia (undefined)	46	Natal
9	New Zealand	47	Orange Free State
• .	Now Zealand	48	Transvaal
	Europe-	49	South Africa (undefined)
10	England	50	Other African Brit. Possns.
11	Wales	50	Egypt Egypt
12	Scotland	52	Other African Countries
13	Ireland	32	Other African Countries
13		-	A
15	Isle of Man	-0	America
16	Other European Brit. Possns.	53	Barbadoes
10	Austria-Hungary	54	Canada
	Belgium	55	Jamaica N
18	Denmark	56	Newfoundland
19	France	57	Other American Brit. Possns.
20	Germany	58	Argentine Republic
21	Greece	59	Brazil
22	Italy	60	Chile
23	Netherlands	61	Mexico
24	Norway	62	Peru
25	Portugal	63	United States of America
26	Russia	64	Other American Countries
27	Spain		
28	Sweden		Polynesia—
29	Switzerland	65	Fiji
30	Other European Countries	66	Friendly Islands
		67	Papua
	Asia—	68	Other Polynesian Brit. Possns.
31	British India	69	New Caledonia
32	Ceylon	70	New Hebrides
33	Hong Kong	71	Samoa
34	Straits Settlements	72	Other Polynesian Islands
35	Other Asiatic British Possns.	73	Sth Sea Islands (so described)
36	Afghanistan	1	
37	Arabia	74	At Sea
38	China	I.	
39	Japan	75	Unspecified ·
	•	Į.	

It will be seen that the principle involved in this classification has been that of grouping the birthplaces under the various continents of birth, and of distinguishing for each continent the British from the foreign birthplaces, the British birthplaces being given first, usually, though not invariably, in alphabetical order, followed by the foreign birthplaces similarly arranged. Every personal card was before tabulation marked with its appropriate birthplace number

and these numbers were used in all subsequent tabulations. To assist in the process of classification an index of birthplaces was prepared. In addition to the totals for each of the 75 items, details in respect of numbers of each sex in each State and Territory were taken out in respect of the countries comprised under the comprehensive items 15, 30, 35, 43, 50, 52, 57, 64, 68 and 72. These details are shewn in their appropriate places in Tables 1 to 3 of Part II. (Birthplaces) of the Detailed Census Tables. See Volume II., pp. 109 to 119.

- 2. Unspecified Birthplaces.—On the present occasion the total number of persons who failed to specify their birthplaces on the Census Schedule was 30,470, of whom 16,418 were males, and 14,052 were females. These somewhat heavy numbers represented 7.1 per 1,000 of the total in the case of the male population and 6.6 per 1,000 in the case of the female population. For the several States and Territories the total unspecified per 1000 of total population worked out as follows:—New South Wales, 6.6; Victoria, 8.4; Queensland, 4.7; South Australia, 5.0; Western Australia, 7.5; Tasmania, 8.1; Northern Territory, 8.5; Federal Territory, 21.6. Leaving the Territories out of account the States with the highest proportion of persons of unspecified birthplace were Victoria and Tasmania, while those with the lowest proportion were Queensland and South Australia. In all cases the proportion was higher than was desirable, and furnished evidence of neglect in the detailed check of the personal cards by certain of the collectors. In the tabulation of the results given in pages 105 to 385 of Volume II., Detailed Tables, the particulars in respect of persons of unspecified birthplace have been tabulated under the heading "Unspecified," but in preparing the figures for this report the data relative to the unspecified have been distributed proportionately. It will be understood, therefore, that in this chapter, unless otherwise indicated, the figures given represent the results obtained after the adjustment made to allow for the unspecified. Similarly in the case of those recorded for "Australia, undefined," a distribution over the several States was carried out. In all cases the figures shewn are exclusive of aboriginal natives of the full blood, but include half-caste aboriginals.
- 3. **General View of Results.**—Dealing first with what may for convenience be termed the Continental division of birthplaces, the following table furnishes a convenient summary of the results for the several States and Territories of enumeration:—

Birthplaces of Population at Census of 3rd April, 1911.

					Sta	TES.			TERRI	TORIES.	
Віктирі	ACE.		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth.
					М	ALES.					
Australasia			703,175	550,444	235,302	175,109	113,819	88,188	1,051	862	1,867,950
Europe			138,277	95,730	82,258	30,249	40,801	8,477	273	121	396,186
Asia			10,493	6,007	8,454	1,042	5,671	586	1,377	5	33,635
Africa			1,096	753	334	194	246	71	9		2,703
America			3,145	1,897	1,230	528	823	186	12	4	7,825
Polynesia			684	122	1,582	23	57	21	11		2,500
At Sea			828	638	346	213	148	62	1		2,236
TOTAL			857,698	655,591	329,506	207,358	161,565	97,591	2,734	992	2,313,035
					FE	MALES					
Australasia			695,772	576,939	215,308	177,579	99,537	86,817	478	672	1,853,102
Europe			88,732	79,553	59,387	22,755	19,956	6,346	42	49	276,820
Asia			1,087	745	492	213	395	201	54		3,187
Africa			917	758	196	165	180	76			2,292
America			1,326	1,123	474	243	313	97		1	3,577
Polynesia			532	159	161	32	31	23	1	·	939
At Sea			670	683	289	213	137	60	i		2,053
TOTAL			789,036	659,960	276,307	201,200	120,549	93,620	576	722	2,141,970
			1		PE	RSONS.		·		<u> </u>	
- Australasia			1.398.947	1,127,383	450.610	352,688	213,356	175,005	1,529	1,534	3,721,052
Europe	• • •	• • •	227,009		141,645	53,004	60,757	14,823	315	170	673,006
Asia		• •	11,580			1,255	6,066	787	1,431	5	36,822
Africa		• • •	2,013		530	359	426	147	9		4,995
America		• • •	4,471			771	1,136	283	12	5	11,402
Polynesia			1,216		1,743	55	88	44	12		3,439
At Sea	• •	• • •	1,498		635	426	285	122	2		4,289
TOTAL			1,646,734	1,315,551	605 813	408,558	282,114	191,211	3,310	1,714	4,455,005

Birthplaces of Population at Census of 3rd April, 1911—continued.

Den moon					STA	TES.	•		TERRI	rories.	
Віктне	LACE.		N. S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH
		MASC	ULINITY	(Excess	of males	over femal	es per 10	of popul	ation).		
Australasia			5.29	- 2.35	4.44	70	6.69	.78	37.48	12.39	.40
Europe			21.83	9.23	16.15	14.14	34.31	14.38	73.33	42.35	17.74
Asia			81.23	77.93	89.00	67.67	86.98	48.92	92.45	100.00	82.69
Africa			8.89	33	26.04	8.08	15.49	- 3.40	100.00		8.23
America			40.68	25.63	44.37	36.96	44.89	31.45	100.00	60.00	37.26
Polynesia			12.50	13.17	81.53	16.36	29.55	4.55	83.33		45.39
At Sea			10.55	- 3.41	8.98		3.86	1.64			4.27
Total			4.17	33	8.78	1.51	14.54	2.08	65.20	15.75	3.84

Note. -- Indicates excess of females over males per 100 of population.

For each of the birthplaces specified the largest numbers were those for New South Wales, Victoria ranking second for all birthplaces except Asia and Polynesia, in which cases Queensland occupied second place and Victoria third.

In the succeeding table is shewn for each sex separately and for the two sexes in combination, the percentage of the number from each birthplace on the total for each State and Territory:—

Percentage for each Birthplace in each State and Territory at Census of 3rd April, 1911.

ъ.					STA	TES.			TERRIT	ORIES.	   a,
BIRTHPL	ACE.		N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
					MA	LES.			,		
Australasia			81.98	83.96	71.41	84.45	70.45	90.37	38.44	86.90	80.76
Europe			16.12	14.60	24.96	14.59	25.25	8.69	9.98	12.20	17.13
Asia			1.22	.92	2.57	.50	3.51	.60	50.37	.50	1.48
Africa			.13	.11	.10	.09	.15	.07	.33		.1:
America		٠.	.37	.29	.37	.26	.51	.19	.44	.40	.3
Polynesia		٠.	.08	.02	.48	.01	.04	.02	.40		.13
At Sea		٠.	.10	.10	.11	.10	.09	.06	.04		.09
Total		• • •	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
					FE	IALES.		,			
Australasia			88.18	87.42	77.93	88.26	82.57	92.73	82.99	93.07	86.5
Europe			11.24	12.06	21.49	11.31	16.55	6.78	7.29	6.79	12.9
Asia	• •		.14	.11	.18	.11	.33	.22	9.38		.1.
Africa	• • •		.12	.12	.07	.08	.15	.08			.1
America			.17	.17	.17	.12	.26	.10		.14	.1
Polynesia			.07	.02	.06	.02	.03	.03	.17		.0
At Sea	• •		.08	.10	.10	.10	.11	.06	.17		.1
Total		٠.	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.0
					PER	SONS.			1		
Australasia			84.96	85.70	74.38	86.33	75.63	91.53	46.20	89.50	83.5
Europe	• •	٠.	13.79	13.32	23.38	12.97	$\begin{array}{c} 75.05 \\ 21.54 \end{array}$	7.75	9.52	9.92	15.1
Asia	• •	٠.	.70	.51	1.48	.31	$\frac{21.34}{2.15}$	.41	$\begin{array}{c} 9.52 \\ 43.23 \end{array}$	.29	.8
Asia Africa	• •	٠.	.10	.12	.09	.09	2.15	.08	.27	.49	.1
Angrica America	• •	. ••	.12	.23	.28	.19	.10	.15	.36	.29	.2
Polynesia	• •	٠.	.07	.02	.29	.01	.03	.02	.36		.0
At Sea	• •	• •	.09	.10	.10	.10	.10	.06	.06	• •	.1
Total	,		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

It will be seen from the preceding table that of the total population of the Commonwealth at the date of the Census only 1.37 per cent. had been born elsewhere than in Australasia or Europe, the percentage for the sexes separately being 2.11 per cent. for males, and 0.57 per cent. for females.

As regards the constitution of the population of the several States, it will be seen that Tasmania furnished the highest proportion of persons of Australasian birth, and the lowest proportion of persons of European birth, while the proportion for other birthplaces, viz., 0.72 per cent., is lower for Tasmania than for any other State except South Australia, where the proportion is 0.70 per cent.

In general it may be said that New South Wales, Victoria and South Australia exhibited a fair degree of similarity of constitution as regards birthplace, whilst Western Australia and Queensland were similar to each other in shewing relatively low proportions of Australasian born population and relatively high proportions of persons of European and Asiatic birth.

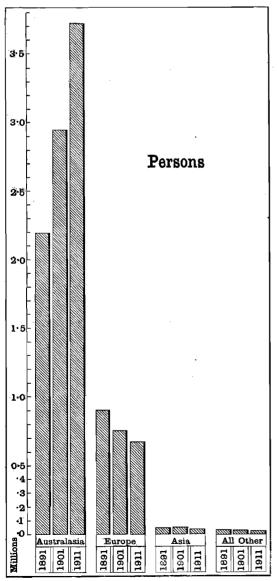
It is of interest to note that for both sexes the number of persons born at sea represented for practically all the States a uniform proportion of about 1 per thousand.

4. Comparative Results for the three Censuses.—A comparison of the birthplace statistics for the Commonwealth for the Censuses of 1891, 1901 and 1911, furnishes the following results:—

BIRTHPLACE		MALES.			Females.			Persons.	
DINIHI DACM	1891.	1901.	1911.	1891.	1901.	1911.	1891.	1901.	1911.
				NUM	BER				
Australasia	1,103,336	1,474,121	1.867.950	1,086,690	1,466,108	1,853,102	2,190,026	2,940,229	3,721,052
Europe	532,418	437,103	396,186	372,255			904,673	755,439	673,006
Asia	44,157	43,875	33,635	2,643	3,248	3,187	46,800	47,123	36,822
Africa	1,835	1,746	2,703	1,219	1,129	2,292	3,054	2,875	4,995
America	9,855	8,910	7,825	3,602	3,625	3,577	13,457	12,535	11,402
Polynesia	9,409	9,420	2,500	1,304	967	939	10,713	10,387	3,439
At Sea	3,029	2,753	2,236	2,640	2,460	2,053	5,669	5,213	4,289
TOTAL	1,704,039	1,977,928	2,313,035	1,470,353	1,795,873	2,141,970	3,174,392	3,773,801	4,455,005

	PERCENTAGE ON TOTAL.														
Australasia	64.75	74.53	80.76	73.91	81.64	86.51	68.99	77.91	83.52						
Europe	31.24	22.10	17.13	25.32	17.73	12.92	28.50	20.02	15.11						
Asia	2.59	2.22	1.45	.18	.18	.15	1.47	1.25	.83						
Africa	.11	.09	.12	.08	.06	.11	.10	.08	.11						
America	.58	.45	.34	.24	.20	.17	.42	.33	.25						
Polynesia	.55	.47	.11	.09	.05	.04	.34	.27	.08						
At Sea	.18	.14	.09	.18	.14	.10	.18	.14	.10						
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00						

#### Birthplaces of Australian Population.



GRAPH No. 19.

It will be seen from the preceding table that between the Census of 1891 and that of 1911 the number of persons in Australia of Australasian birth increased by upwards of 1,530,000, while the percentage on total population increased from 69 per cent. to upwards of  $83\frac{1}{2}$  per cent. During the same period the population of European birth diminished by upwards of 231,000 in number, and in proportion from  $28\frac{1}{2}$  per cent. to 15 per cent. of the total. The population from all other birthplaces taken together diminished in number by nearly 19,000, and in proportion from  $2\frac{1}{2}$  per cent. to  $1\frac{1}{3}$  per cent. of the total population.

It is of interest to note that the only one of the birthplaces specified, other than Australasia, which shewed a higher number and proportion in 1911 than in 1891 or 1901 was Africa, mainly due to an increase in the number of immigrants from South Africa arising as a consequence of the Australian intervention in the South African War at the commencement of the decade. Both numerically and proportionately the Asiatic and Polynesian races diminished rapidly during the twenty years under review.

The accompanying graph (No. 19) furnishes a representation of the number of persons (males and females combined) enumerated at the Australian Censuses of 1891, 1901 and 1911, who had been born in "Australasia," "Europe," "Asia," and "all other birthplaces" respectively. This graph brings out clearly the increase in the number of Australian born and the decrease in the number born elsewhere, which has taken place in the 20 years covered by the graph.

The masculinity of the population for each birthplace is shewn in the following table:—

Masculinity of Australian Population according to Birthplace, 1891 to 1911. (Excess of Males over Females per 100 for Sexes combined for the Birthplaces in question).

					Birthplace	•			
CENSU	s.	Aus- tralasia.	Europe.	Asia.	Africa.	America.	Polynesia.	At Sea.	Total
1891 1901 <b>191</b> 1		.76 .27 .40	17.70 15.72 17.74	88.71 86.21 82.69	20.17 21.46 8.23	46.46 42.16 37.26	75.66 81.38 45.39	6.86 .56 4.27	7.36 4.82 3.84

5. **British Subjects.**—Amongst the questions put at the recent Census was one relating to nationality, each person being asked to state if he were a British Subject by parentage or by naturalisation. In addition to these all persons born in British possessions were in tabulation classified as British subjects by birthplace, while the foreign born wives of British subjects were tabulated as British subjects by naturalisation, in accordance with the provisions of the Commonwealth Naturalisation Act. In the succeeding table the results obtained are shewn for each of the continental divisions of birthplaces.

British Subjects in Australia at the Census of 3rd April, 1911.

					Brr	гізн Ѕ∪вје	CT.	Total		Total	
I	3irthi ———	PLACE.			By Birthplace.	By Parentage.	By Naturalisa- tion.	British Subjects.	Others.	Popula- tion.	
						MALES.					
Australasia					1,867,950			1,867,950		1,867,950	
Europe					342,546	1,857	34.002	378,405	17,781	396,186	
Asia T					6,719	294	4,081	11,094	22,541	33,635	
Africa					2,484	67	90	2,641	62	2,703	
America					2,687	2,516	1,184	6,387	1,438		
Polynesia					1,126	300	223	1,649	1,438 851	7,825	
At Sea	• •		• •			2,071	99	2,170	66	2,500 2,236	
Tota	Ľ	• •	• •		2,223,512	7,105	39,679	2,270,296	42,739	2,313,035	
					:	FEMALES.					
Australasia					1,853,102			1,853,102		1,853,102	
Europe					258,158	1,508	12,432	272,098	4,722	276,820	
Asia -					1,898	173	369	2,440	747	3,187	
Africa					2,193	61	19	2,273	19	2,292	
America					1,049	1,702	334	3,085	492	3,577	
Polynesia					535	205	52	792	147	939	
At Sea	• •	• •		· • •		1,940	61	2,001	52	2,053	
at Soa									<del></del>		
Тота	:	••	• •	• •	2,116,935	5,589	13,267	2,135,791	6,179	<b>2,141,97</b> 0	
		••	••	••		5,589 PERSONS.	13,267	2,135,791	6,179	2,141,970	
Тота						PERSONS.			6,179		
Tota	: 				3,721,052	PERSONS.		3,721,052		3,721,052	
Tota:					3,721,052 600,704	PERSONS 3,365	46,434	3,721,052 650,503	22,503	3,721,052 673,006	
Tota Australasia Europe Asia			• •		3,721,052 600,704 8,617	PERSONS 3,365 467	 46,434 4,450	3,721,052 650,503 13,534	 22,503 23,288	3,721,052 673,006 36,822	
Tota Australasia Europe Asia Africa			• • • • • • • • • • • • • • • • • • • •		3,721,052 600,704 8,617 4,677	PERSONS 3,365 467 128	 46,434 4,450 109	3,721,052 650,503 13,534 4,914	22,503 23,288 81	3,721,052 673,006 36,822 4,995	
Tota: Australasia Europe Asia Africa America					3,721,052 600,704 8,617 4,677 3,736	PERSONS.  3,365 467 128 4,218	 46,434 4,450 109 1,518	3,721,052 650,503 13,534 4,914 9,472	22,503 23,288 81 1,930	3,721,052 673,006 36,822 4,995 11,402	
			• • • • • • • • • • • • • • • • • • • •		3,721,052 600,704 8,617 4,677	PERSONS 3,365 467 128	 46,434 4,450 109	3,721,052 650,503 13,534 4,914	22,503 23,288 81	3,721,052 673,006	

These figures given shew that less than 2 per cent. of the male population of the Commonwealth, and only about 3 per 1000 of the female population were foreign subjects. Taking the sexes together, 1.1 per cent. of the whole population of the Commonwealth at the date of the Census were foreign subjects.

6. **Metropolitan Population.**—An interesting point in connexion with the question of birthplace is the relative extent to which those born in different parts tend to aggregate in the Metropolitan areas of the several States. For the various Continental divisions of birthplaces, the number of persons of each sex resident in each of the Metropolitan areas is shewn in the following table:—

Metropolitan Population according to Birthplace, 3rd April, 1911.

$\operatorname{Birthpl}$	ace.		Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan.
				M	IALES.	4			
Australasia			236,877	226,386	47,510	74,315	38,644	16,346	640,078
Europe			62,208	46,756	19,082	15,428	13,171	1,954	158,599
Asia			3,891	2,940	553	368	994	117	8,863
Africa			610	490	72	113	77	22	1,384
America			1,458	1,046	292	251	277	27	3,351
Polynesia	• •	• •	365	67	46	11	15	6	510
At Sea		• •	319	271	73	92	53	15	823
TOTAL	• •		305,728	277,956	67,628	90,578	53,231	18,487	813,608
				F	EMALES.				
Australasia			271,270	264,649	52,154	84,649	42,716	19,503	734,941
Europe			49,695	44,112	19,191	13,839	10,337	1,801	138,975
Asia			584	524	133	145	167	50	1,603
Africa			605	542	72	130	87	30	1,466
America	• •		874	720	184	161	161	31	2,131
Polynesia	• •	• •	398	99	20	19	18	16	570
At Sea		• •	349	369	98	125	75	19	1,035
	••	• •		309		120			1,030
Total	• •	• •	323,775	311,015	71,852	99,068	53,561	21,450	880,721
				~	an a o sta				
				P.	ERSONS.				
Australasia			508,147	491,035	99,664	158,964	81,360	35,849	1,375,019
Europe			111,903	90,868	38,273	29,267	23,508	3,755	297,574
Asia			4,475	3,464	686	513	1,161	167	10,466
Africa			1,215	1,032	144	243	164	52	2,850
America			2,332	1,766	476	412	438	58	5,482
Polynesia			763	166	66	, 30	33	22	1,080
At Sea		• •	668	640	171	217	128	$\overline{34}$	1,858
TOTAL			629,503	588,971	139,480	189,646	106,792	39,937	1,694,329

For the total population Sydney contains the greatest number in respect of each of the birthplaces specified, while Melbourne ranks second throughout. Brisbane occupies third place in respect of Europe, America and Polynesia; Adelaide is third with Australasia, Africa, At Sea, and Total, while Perth is third in the case of Asia.

The succeeding table furnishes similar information respecting the proportion per cent. which the Metropolitan numbers for each sex and birthplace bore to the total for that sex and birthplace in the whole State or Commonwealth.

Proportion per cent. Resident in Metropolitan Areas, 3rd April, 1911.

Birthpla	ce.		N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	C'wlth
		-			MALES.				
Australasia			% 33.69	% 41.13	% 20.19	% 42.44	% 33.95	% 18.54	% 34.27
Europe	• •	• •	44.99	48.84	23.20	51.00	32.28	23.05	40.03
Asia	• • •		37.08	48.94	6.54	35.32	17.53	19.97	26.35
Africa			55.66	65.07	21.56	58.25	31.30	30.99	51.20
America			46.36	55.14	23.74	47.54	33,66	14.50	42.82
Polynesia			53.36	54.92	2.91	47.83	26.32	28.57	20.40
At Sea	• •	• •	38.53	42.48	21.10	43.19	35.81	24.19	36.81
TOTAL			35.65	42.40	20.52	43.68	32.95	18.94	35.17

Proportion per cent. Resident in Metropolitan Areas, 3rd April, 1911—continued.

Birthpl	lace.		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	C'wealth
				FE	MALES.		·		
Australasia			38.99	45.87	24.22	47.67	42.91	22.46	39.66
Europe			56.01	55.45	32.32	60.82	51.80	28.38	50.20
Asia			53.73	70.34	27.03	68.08	42.28	24.88	50.30
Africa			65.98	71.50	36.73	78.79	48.33	39.47	63.96
America			65.91	64.11	38.82	66.26	51.44	31.96	59.58
Polynesia			74.81	62.26	12.42	59.38	58.06	69.57	60.70
At Sea			52.09	54.03	33.91	58.69	54.74	31.67	50.41
TOTAL	• •		41.03	47.13	26.00	49.24	44.43	22.91	41.12
				PI	ERSONS.				
Australasia			36.32	43.56	22.12	45.07	38.13	20.48	36.95
Europe			49.29	51.84	27.02	55.22	38.69	25.33	44.22
Asia			38.64	51.30	7.67	40.88	19.14	21.22	28.42
Africa			60.36	68.30	27.17	67.69	38.50	35.37	57.06
America			52.16	58.48	27.93	53.44	38.56	20.49	48.08
Polynesia			62.75	59.07	3.79	54.55	37.50	50.00	31.40
At Sea	• •	• •	44.59	48.45	26.93	50.94	44.91	27.87	43.32
TOTAL			38.23	44.77	23.02	46.42	37.85	20.89	38.03

From these tables it will be seen that the tendency for the Australasian born to concentrate in Metropolitan areas is less marked than is the case for most other of the birthplaces enumerated. Thus, whilst 36.95 per cent. of the Australasian-born population of the Commonwealth was to be found in Metropolitan areas, as high a percentage as 44.22 of the European-born population was so found. As regards Australasian and European born population this relation holds good for both sexes in all the States except in the case of males in Western Australia. It is most marked in the case of New South Wales, where for the sexes combined 36.32 per cent. of the Australasian-born population of the State dwelt in Sydney, whilst 49.29 per cent. of the European-born population were so resident.

In this connexion it is also of interest to note that whilst in the case of the Australasianborn the females in every instance largely exceeded the males, the reverse held true in the case of the European-born for all Metropolitan areas except Brisbane. It may be noted as a matter of curiosity that in all the Metropolitan areas the females born at sea exceeded the males so born

7. Birthplace and Age.—At the Commonwealth Census of 1911 much more complete details of birthplaces and ages in conjunction were tabulated than had previously been the case with Australian Censuses. This detail comprised for each State and Territory, and for each sex, the compilation of particulars in respect of single ages 0 to 4, and quinquennial groups thence forward, the information being furnished in respect of each of the 75 birthplace items comprised in the classification of birthplaces. (See p. 114).

For the Continental divisions of birthplaces the particulars in respect of males are as follows:—

Male Population of Australia according to Birthplace and Age, 3rd April, 1911.

Age Last Birthday.	Austral- asia.	Europe.	Asia.	Africa.	America.	Polynesia.	At Sea.	Total.
0	59,095	127	8		4	9	5	59,248
1	54,241	378	15	15	18	15	5	54,687
2	51,059	533	18	48	25	9	3	51,695
3	51,005	673	26	78	31	15	3	51,831
4	49,753	686	18	120	19	14	2	50,612
5-9	225,774	3,635	113	446	102	79	10	230,159
10-14	212,298	3,484	170	214	94	75	9	216,344
15-19	220,503	6,813	545	82	184	182	20	228,329
20-24	206,507	20,107	2,021	184	<b>492</b>	319	72	229,702
25-29	105 500	28,954	3,240	285	686	228	164	201,263
30-34	136,852	29,689	4,461	218	688	202	166	172,276
35-39	117,300	29,291	4,902	157	847	274	132	152,903
40-44	105,263	34,292	4,911	158	718	355	151	145,848
45-49	85,281	43,238	3,944	221	751	270	271	133,976
50-54	61,237	42,626	3,482	160	802	226	326	108,859
55-59	01 144	37,924	2,099	114	711	103	446	72,541
60-64	16,435	32,937	1,487	88	555	68	189	51,759
65-69	10,650	28,481	793	51	377	31	108	40,491
70-74	3,811	24,327	655	26	$\bf 324$	15	97	29,255
<b>7</b> 5–79	1 411	16,818	429	29	$\bf 224$	9	31	18,951
80-84	457	8,053	203	7	122	1	20	8,863
85-89	120	2,419	70	. 1	37	1	3	2,651
90-94	35	582	12		- 11		1	641
95–99	10	93	8		3		<b>2</b>	116
100 & over	3	26	5	1	• •	••		35
TOTAL	1,867,950	396,186	33,635	2,703	7,825	2,500	2,236	2,313,035

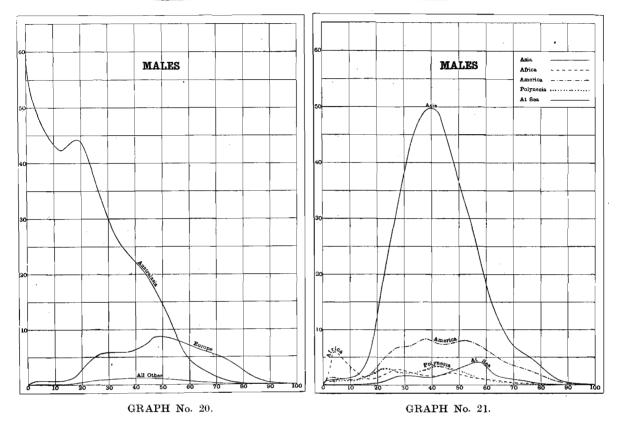
The following graphs (Nos. 20 and 21) furnish a representation of the number of males at each age according to the birthplaces specified in the preceding table. In each case the base of a small square represents 10 years of age. In the case of graph No. 20 the height of a small square represents 5000 persons, while in graph No. 21 it represents 500 persons.

# Ages and Birthplaces— Australasia, Europe, and all other Birthplaces. Census of 1911

Ages and Birthplaces—
Asia, Africa, America, Polynesia, and at Sea.
Census of 1911.

MALES.

MALES.



Similar particulars in respect of the female population are furnished in the succeeding table.

Female Population of Australia according to Birthplace and Age, 3rd April, 1911.

Age La Birthda		Austral- asia.	Europe.	Asia.	Africa.	America.	Polynesia.	At Sea.	Total.
0		56,579	120	1	4	6	4	8	56,722
1		52,380	359	10	13	17	15	4	52,798
2		49,361	548	17	32	27	7	6	49,998
3	٠.	49,762	634	14	73	20	7	1	50,51
4		48,014	623	20	123	26	14	1	48,821
5-9		220,122	3,315	94	497	96	73	9	224,206
10-14	٠.	209,046	3,351	114	185	89	72	13	212,870
1519	٠.	219,184	3,477	133	99	137	90	18	223,138
20-24	٠.	210,996	7,751	227	127	212	101	81	219,495
25-29	٠.	172,632	15,814	381	266	294	116	166	189,669
30-34		140,127	19,599	416	158	317	114	147	160,878
3539	٠.	118,122	21,057	437	127	463	113	148	140,467
10-44	٠.	101,957	22,530	359	95	324	70	127	125,462
<b>4549</b>	٠.	82,083	26,201	279	144	243	48	244	109,242
50-54		58,885	25,545	180	85	337	40	264	85,336
55–59		30,053	26,225	133	100	335	17	427	57,290
80-64	٠.	16,387	27,208	153	71	245	17	181	44,262
6569		11,102	25,198	100	40	160	12	88	36,700
70-74		4,093	21,803	65	23	104	5	83	26,176
75–79	٠.	1,533	14,931	34	16	70	1	24	16,609
80-84		499	7,175	15	9	29	3	10	7,740
35-89		145	2,544	5	4	20	l ŀ	<b>2</b>	2,720
90-94		28	670		1	4	l l	1	704
95-99	٠.	9	116			2	l		12'
100 & ov		3	26	]		• •			29
TOTAL		1,853,102	276,820	3,187	2,292	3,577	939	2,053	2,141,970

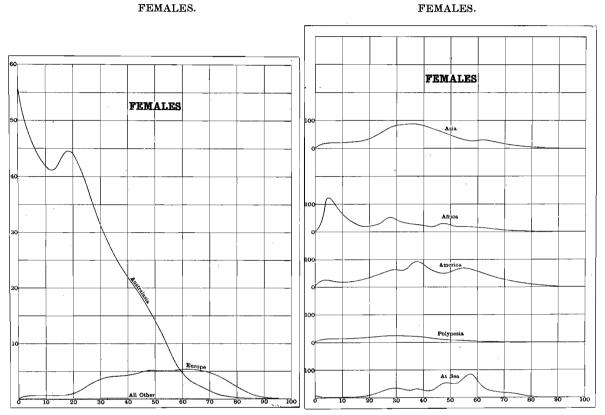
A representation of the number of females of each age for the birthplaces specified in the foregoing table is furnished in the following graphs (Nos. 22 and 23). In each case the base of each small square represents 10 years of age. The height of each small square represents 5000 persons in the case of graph No. 22, and 100 persons in the case of graph No. 23.

Ages and Birthplaces-Australasia, Europe, and All Other. Census of 1911.

Ages and Birthplaces-Asia, Africa, America, Polynesia, and At Sea. Census of 1911.

FEMALES.

GRAPH No. 23.



For the two sexes combined the particulars are as follows:---

GRAPH No. 22.

Total Population of Australia according to Birthplace and Age, 3rd April, 1911.

Age Last Birthday.	Austral- asia.	Europe.	Asia.	Africa.	America.	Polynesia.	At Sea.	Total.
0 .	. 115,674	247	9	4	10	13	13	115,970
1 .	. 106,621	737	25	28	35	30	9	107,488
2 . 3 .	. 100,420	1,081	35	80	52	16	9	101,693
3 .	100,767	1,307	40	151	51	22	4	102,342
4 .	97,767	1,309	38	243	45	28	3	99,433
5-9 .	445,896	6,950	207	943	198	152	19	454,36
.0–14	421,344	6,835	284	399	183	147	22	429,214
.5-19	439,687	10,290	678	181	321	272	38	451,46
0-24	417,503	27,858	2,248	311	704	420	153	449,19
5-29	340,338	44,768	3,621	551	980	344	330	390,93
30–34	276,979	49,288	4,877	376	1,005	316	313	333,154
5-39	235,422	50,348	5,339	284	1,310	387	280	293,370
0–44	207,220	56,822	5,270	253	1,042	425	278	271.310
5-49	167,364	69,439	4,223	365	994	318	515	243,218
60–54	120,122	68,171	3,662	245	1,139	266	590	194,19
55-59	61,197	64,149	2,232	214	1,046	120	873	129,83
60–64	32,822	60,145	1,640	159	800	85	370	96,02
5-69	21,752	53,679	893	91	537	43	196	77,19
70–74	7,904	46,130	720	49	428	20	180	55,43
5-79	0.044	31,749	463	45	294	10	55	35,560
0-84	956	15,228	218	16	151	4	30	16,603
5-89	265	4,963	75	5	. 57	1	5	5,371
0-94	63	1,252	12	1	15		2	1,345
5-99	19	209	8		5		2	243
00 & over	6	52	5	1	••		••	64
TOTAL	3,721,052	673,006	36,822	4,995	11,402	3,439	4,289	4,455,008

The next table furnishes for each birthplace the percentage which the population for the sexes combined in each quinquennial group bore to the total for the birthplace in question.

Age-Group Percentage of Total Population of Australia for each Birthplace, 3rd April, 1911.

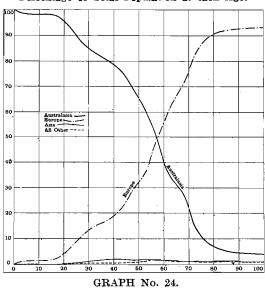
Age Last Birthday.	Austral- asia.	Europe.	Asia.	Africa.	America.	Polynesia.	At Sea.	Total.
0-4	14.01	.69	.40	10.13	1.69	3.17	.88	11.83
5-9	11.98	1.03	.56	18.88	1.74	4.42	.44	10.20
10–14	11.32	1.02	.77	7.99	1.61	4.27	.51	9.63
15–19	11.82	1.53	1.84	3.62	2.82	7.91	.88	10.13
20–24	11.22	4.14	6.11	6.23	6.17	12.21	3.57	10.13
<b>25–2</b> 9	9.15	6.65	9.83	11.03	8.60	10.00	7.69	8.78
30–34	7.44	7.32	13.25	7.53	8.81	9.19	7.30	7.48
35–39	6.33	7.48	14.50	5.69	11.49	11.25	6.53	6.59
10–44	5.57	8.44	14.31	5.07	9.14	12.36	6.48	6.09
45-49	4.50	10.32	11.47	7.31	8.72	9.25	12.01	5.46
50-54	3.23	10.13	9.95	4.90	9.99	7.74	13.76	4.36
55-59	1.64	9.53	6.06	4.28	9.17	3.49	20.35	2.91
30–64	.88	8.94	4.45	3.18	7.02	2.47	8.63	2.16
65-69	. 58	7.98	2.43	1.82	4.71	1.25	4.57	1.73
70-74	.21	6.85	1.96	.98	3.75	.58	4.20	1.24
75–79	.08	4.72	1.26	.90	2.58	.29	1.28	.80
30–84	.03	2.26	.59	.32	1.32	.12	.70	.37
35–89	.01	.74	.20	.10	.50	.03	.12	.12
90–94	• •	.19	.03	.02	.13		.05	.03
95-99		.03	.02		.04		.05	.01
100 & over		.01	.01	.02	••			• •
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

From the succeeding table, which shews for each age group the proportion per cent. born in each of the birthplaces specified, it will be seen that the Australasian proportion which was 98.92 per cent. for the group 0-4, declined almost continuously throughout, reaching 50 per cent. at approximately age 56. In other words, at all ages under 56 more than half the population of the Commonwealth were Australasian-born, whilst at all ages above 56 less than half were so born.

Birthplace Percentage of Total Population of Australia in each Age Group, 3rd April, 1911.

Age Last Birthday.	Austral- asia.	Europe.	Asia.	Africa.	America.	Polynesia.	At Sea.	Total
0–4	98.92	.89	.03	.09	.04	.02	.01	100.00
5–9	98.14	1.53	.05	.21	.04	.03	.00	100.00
0–14	98.17	1.59	.07	.09	.04	.03	.01	100.00
5-19	97.39	2.28	.15	.04	.07	.06	.01	100.00
20–24	92.95	6.20	.50	.07	.16	.09	.03	100.00
5-29	87.06	11.45	.93	.14	.25	.09	.08	100.00
30–34	83.14	14.80	1.46	.11	.30	.10	.09	100.00
5-39	80.25	17.16	1.82	.10	.45	.13	.09	100.00
0–44	76.38	20.94	1.94	.09	.39	.16	.10	100.00
5–49	68.81	28.55	1.74	.15	.41	.13	.21	100.00
0-54	61.86	35.10	1.88	.13	.59	.14	.30	100.00
5-59	47.14	49.41	1.72	.16	.81	.09	.67	100.00
0-64	34.18	62.64	1.71	.17	.83	.09	.38	100.00
5-69	28.18	69.54	1.16	.12	.69	.06	.25	100.00
0-74	14.26	83.22	1.30	.09	.77	.04	.32	100.00
5-79	8.28	89.28	1.30	.13	.83	.03	.15	100.00
0-84	5.76	91.72	1.31	.10	.91	.02	.18	100.00
5-89	4.94	92.40	1.40	.09	1.06	.02	.09	100.00
0-94	4.68	93.09	.89	.07	1.12		.15	100.00
5-99	7.82	86.01	3.29		2.06		.82	100.00
00 & over	9.38	81.25	7.81	1.56	••	••	••	100.00
ALL AGES	83.52	15.11	.83	.11	.25	.08	.10	100.00





The accompanying graph (No. furnishes for the Census of 3rd April, 1911, a representation of the proportion of the total population of Australia at each age, that had been born in "Australasia," "Europe," "Asia," and "All other birthplaces," respectively. The base of each small square represents 10 years of age, while the height represents 10 per cent. of the population of Australia for the age in question. This graph furnishes an interesting representation of the relative insignificance of population other than of Australasian or European birth. The curves representing the populations born in Europe and Australasia intersect slightly below the 50 per cent. horizontal line at a point corresponding to about age 56.

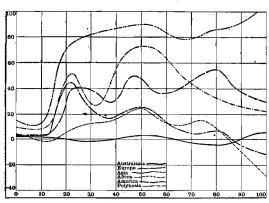
The masculinity of the population of the Commonwealth, according to birthplace and age, is shewn in the following table:—

Masculinity of Commonwealth Population (excess of Males over Females per 100 of Sexes combined for each Birthplace), 3rd April, 1911.

Age La					BIRTHPLAC	CE.			Total.
Birthd	ay.	Austral- asia.	Europe.	Asia.	Africa.	America.	Polynesia.	At Sea.	10001
0-4	!	1.74	2.41	15.65	3.16	.52	13.76	<b></b> 5.26	1.75
5-9		1.27	4.60	9.18	5.41	3.03	3.95	5.26	1.31
0-14		.77	1.95	19.72	7.27	2.73	2.04	18.19	.81
5-19		.30	32.42	60.77	9.39	14.64	33.82	5.26	1.15
20-24		- 1.08	44.35	79.80	18.33	39.77	51.90	5.88	2.27
5-29		-1.44	29.36	78.96	3.45	40.00	32.56	61	2.97
0-34		-1.18	20.47	82.94	15.96	36.92	27.85	6.07	3.42
5-39		35	16.35	83.63	10.56	29.31	41.60	5.71	4.24
0-44		1.60	20.70	86.38	24.90	37.81	67.06	8.63	7.51
5-49		1.91	24.54	86.79	21.10	51.11	69.81	5.24	10.17
0-54	!	1.96	25.06	90.17	30.61	40.83	69.92	10.51	12.11
5-59		1.78	18.24	88.08	6.54	35.95	71.67	21.76	11.75
0-64		.15	9.53	81.34	10.69	38.75	60.00	2.16	7.81
569		2.08	6.12	77.60	12.09	40.41	44.19	10.20	4.9
0-74		-3.57	5.47	81.94	6.12	51.40	50.00	7.78	5.5
5-79		4.14	5.94	85.31	28.89	52.38	80.00	12.73	6.59
0-84	!	-4.39	5.77	86.24	-12.50	61.59	50.00	33.33	6.76
5-89		-9.43	-2.52	86.67	60.00	29.82	100.00	20.00	1.28
0-94		11.11	7.03	100.00	100.00	46.67			4.68
5-99		5.26	-11.01	100.00		20.00		100.00	4.5
00 & o	1			100.00	100.00	• •		• •	9.3
ALL	Ages	.40	17.74	82,69	8.23	37.26	45.39	4.27	3.8

Note. — denotes excess of females over males per 100 of population.

#### Masculinity According to Birthplace and Age.



GRAPH No. 25.

The accompanying graph (No. 25) furnishes a representation of the masculinity of the population of Australia at the Census of 3rd April, 1911, according to birth-place and age. The base of each small square represents 10 years of age, while the height represents a masculinity of 20. It will be seen that the masculinity curve for persons of Australasian birth oscillates with age about the line of zero masculinity, and does not at any stage diverge greatly from it. All the other curves have much more extensive oscillations, and, except in two instances at extreme ages, are well above the zero line.

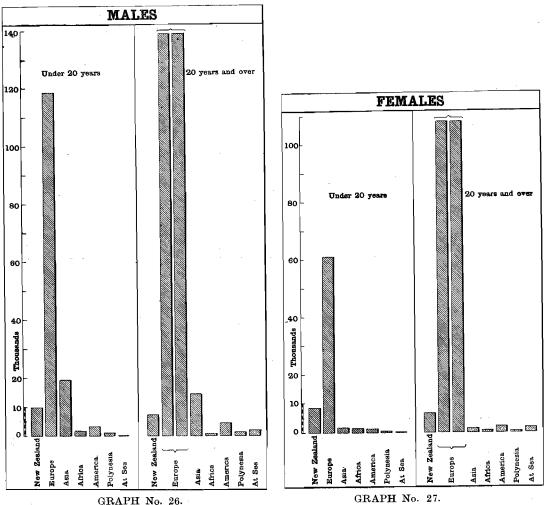
8. Birthplace and Length of Residence.—Omitting the persons whose birthplaces were unspecified, there were 756,865 persons resident in the Commonwealth at the date of the Census whose birthplace was recorded as other than Australia. Of these 216,330 stated that they had been in the Commonwealth less than 20 years, 500,639 stated that they had been so resident for 20 years or upwards, while 39,896 failed to specify their length of residence. After adjustment of the results to allow in due proportion for those unspecified as to birthplace as well as for those unspecified as to length of residence, the figures for birthplace and length of residence, in combination are as follows:—

Length of Residence of Oversea Population of Australia, 3rd April, 1911.

		MALES.			FEMALES.		Persons.			
Birthplace.	Under 20 Years.	20 Years & over.	Total.	Under 20 Years.	20 Years & over.	Total.	Under 20 Years.	20 Years & over.	Total.	
New Zealand	9,799	7,199	16,998	8,587	6,532	15,119	18,386	13,731	32,117	
Europe	118,595	277,591	396,186	61,017	215,803	276,820	179,612	493,394	673,006	
Asia	19,372	14,263	33,635	1,702	1,485	3,187	21,074	15,748	36,822	
Africa	1,755	948	2,703	1,560	732	2,292	3,315	1,680	4,995	
America	3,328	4,497	7,825	1,376	2,201	3,577	4,704	6,698	11,402	
Polynesia	1,132	1,368	2,500	534	405	939	1,666	1,773	3,439	
At Sea	239	1,997	2,236	233	1,820	2,053	472	3,817	4,289	
TOTAL	154,220	307,863	462,083	75,009	228,978	303,987	229,229	536,841	766,070	

For the oversea population as a whole, 70 per cent. had, at the date of the Census, been resident in Australia for 20 years or more, the corresponding proportion for males being 67 per cent., and for females 75 per cent. For the birthplaces specified above, the corresponding proportions for the sexes combined were as follows:—New Zealand, 43 per cent.; Europe, 73 per cent.; Asia, 43 per cent.; Africa, 34 per cent.; America, 59 per cent.; Polynesia, 52 per cent.; At Sea, 89 per cent.

Length of Residence of Oversea Population, 3rd April, 1911.



The accompanying graphs (Nos. 26 and 27) furnish a representation of the length of residence of the oversea population of Australia at the Census of 1911, the particulars being furnished separately for the two sexes. The scales are the same for the two graphs.

9. Birthplace and Education.—On the present occasion particulars respecting the elementary education of the population have been tabulated and published in conjunction with birthplace. This had previously been done for some of the States, but not for all. The particulars relative to education which were asked at the Census were very meagre relating as they did solely to the ability to read or write English, or failing that to read or write a foreign language. The following table furnishes particulars of this nature for the Continental divisions of birthplaces for the population aged 5 years and upwards. All persons, irrespective of birthplace, who were under the age of 5 were classed as unable to read, even though the cards in respect of them had indicated ability to read or read and write, as it was considered that unless in exceptional cases the degree of proficiency attained at age 5 would be negligible.

Birthplace and Education.—Commonwealth Population aged 5 and upwards, 3rd April, 1911.

D			Engli	ISH.	Foreign Lan	GUAGE ONLY.	Cannot	Total, 5 Years
BIRT	HPLAC	Е.	Read & Write	Read only.	Read & Write	Read only.	Read.	& upwards
·								
Australasia			1,539,335	3,227	80	32	60,123	1,602,797
Europe			368,529	2,939	9,611	674	12,036	393,789
Asia			8,340	172	16,061	1,848	7,129	33,550
Africa			2,179	15	52	3	193	2,442
America			7,447	43	40	4	194	7,728
Polynesia			976	101	32	5	1.324	2,438
At Sea			2,101	19	3	2	93	2,218
Тота	L		1,928,907	6,516	25,879	2,568	81,092	2,044,962
				FI	EMALES.		70.0000	
Australasia			1,544,563	3,354	80	13	48,996	1,597,006
Europe			252,413	5,572	3,703	455	12,393	274,536
Asia			2,323	29	334	34	405	3,125
Africa			1,863	13	15	2	154	2,047
America			3,406	15	10	-	50	3,481
Polynesia		• • •	775	5	31	2	79	892
At Sea		• • •	1,940	20	9	ĩ	63	2,033
Тота	L		1,807,283	9,008	4,182	507	62,140	1,883,120
				P	ERSONS.			
Australasia			3,083,898	6,581	160	45	109,119	3.199.803
Europe			620,942	8,511	13,314	1,129	24,429	668,325
Asia	• •		10,663	201	16,395	1,882	7,534	36,675
Africa			4,042	28	67	5	347	4,489
America		• • •	10,853	58	50	4	244	11,209
Polynesia		• • •	1,751	106	63	7	1.403	3,330
At Sea	• •		4,041	39	12	3	156	4,251
Тота	L		3,736,190	15,524	30,061	3,075	143,232	3,928,082

The following table furnishes for each of the Continental divisions of birthplaces the percentage of persons aged 5 years and upwards who at the date of the Census were recorded as being unable to read.

Percentage of Persons Aged 5 and Upwards who were Unable to Read, 3rd April, 1911.

Birthplace.	Males.	Females.	Persons.	Birthplace.	Males.	Females.	Persons.
Australasia Europe	3.75 $3.06$ $21.25$ $7.90$	3.07 $4.51$ $12.96$ $7.52$	3.41 $3.66$ $20.54$ $7.73$	America Polynesia At Sea	$2.51 \\ 54.31 \\ 4.19$	1.44 8.86 3.10	2.18 $42.13$ $3.67$
Airica	1.50	7.02		TOTAL	3.97	3.30	3.65

10. Birthplace and Conjugal Condition.—In connexion with the tabulation of data relative to birthplace, particulars of Conjugal Condition were tabulated on the present occasion for each sex and for each State and Territory in respect of the 75 items included in the birthplace classification. The figures in respect of population aged 15 years and upwards are given in the following table for each of the Continental divisions of birthplaces.

Birthplace and Conjugal Condition of Persons Aged 15 and Upwards, 3rd April, 1911.

1	Birthplace.				Married.	Never Married	Widowed.	Divorced.	Total, 15 & upwards			
MALES.												
Australasia					491,858	647,395	23,996	1,476	1,164,725			
Europe					227,746	120,161	37,976	787	386,670			
Asia T					11,766	20,604	861	36	33,267			
Africa					893	783	93	13	1,782			
America					3,778	3,023	684	47	7,532			
Polynesia					594	1,618	67	5	2,284			
At Sea	• •	• •	• •		1,470	541	184	4	2,199			
Тота	L				738,105_	794,125	63,861	2,368	1,598,459			

Birthplace and Conjugal Condition of Persons Aged 15 and Upwards, 3rd April, 1911—continued.

	Birt	hplace.			Married.	Never Married.	Widowed.	Divorced.	Total, 15 & upwards
					FEM	ALES.			
Australasia					570,273	541,285	54,580	1,700	1,167,838
Europe					157,387	38,346	71,723	414	267,870
Asia					1,852	675	385	5	2,917
Africa					844	317	201	3	1,365
America					1,926	754	603	13	3,296
Polynesia					358	348	37	4	747
At Sea	• •	• •	• •	• •	1,248	330	432	1	2,011
TOTAL	L	• •	• •	• •	733,888	582,055	127,961	2,140	1,446,044
					PER	sons.			
Australasia					1,062,131	1,188,680	78,576	3,176	2,332,563
Europe					385,133	158,507	109,699	1,201	654,540
Asia					13,618	21,279	1,246	41	36,184
Africa					1,737	1,100	294	16	3,147
America					5,704	3,777	1,287	60	10,828
Polynesia					952	1,966	104	9	3,031
At Sea					2,718	871	616	5	4,210
Тота	<b>L</b>				1,471,993	1,376,180	191,822	4,508	3,044,503

11. Birthplace and Religion.—A further innovation introduced into the tabulation of birthplace data for the present Census is the compilation of results shewing particulars for birthplace in conjunction with religion. These particulars are given in Volume II., pp. 238 to 291 of the detailed tables, for each sex, in respect of the Commonwealth as a whole and also in respect of each State and Territory. Details are furnished for each of the 75 items comprised in the birthplace classification in conjunction with each of the 30 items comprised in that relating to religion. For the total population of the Commonwealth the particulars in respect of the Continental divisions of birthplaces are as follows:—

Birthplace and Religion.—Total Commonwealth Population, 3rd April, 1911.

Religion,	Aus- tralasia.	Europe.	Asia.	Africa.	America	Polynesia.	At Sea.	Total.
CHRISTIAN—					1			
Church of England	1,489,510	251,049	5,460	2,157	4,050	1,461	1,786	1,755,473
Presbyterian	470,905	98,031	1,068	535	1,496	403	635	573,073
Methodist	492,898	65,142	926	445	1,084	548	507	561,550
Baptist	81,900	16,890	167	134	362	9	93	99,555
Congregational	62,270	13,098	101	90	207	111	71	75,948
Lutheran	51,544	22,699	27	35	121	14	68	74,508
Church of Christ	34,795	4,509	219	42	91	30	46	39,732
Salvation Army	23,168	3,962	44	21	50	45	58	27,348
Seventh Day Adventists	5,147	962	18	9	94	11	8	6,249
Unitarian	1,171	1,017	14	5	37		4	2,248
Protestant (undefined)	83,108	28,720	329	185	555	120	144	113,161
Roman Catholic	806,871	131,193	3,008	903	2,195	360	716	945,246
Greek Catholic	415	2,013	345	27	9	3	2	2,814
Catholic (undefined) .,	66,417	10,182	419	64	226	54	48	77,410
Others	22,379	9,083	329	117	263	71	27	32,269
TOTAL CHRISTIAN	3,692,498	658,550	12,474	4,769	10,840	3,240	4,213	4,386,584
NON-CHRISTIAN								
Hebrew	11,373	5,943	228	127	134	20	12	17,837
Confucian	245	2	6,414		1		1	6,663
Mohammedan	299	27	4,611	29	2	1	2	4,971
Buddhist	59	25	4,100	1	2			4,187
Pagan	68	14	1,755		2	17		1,856
Others	571	365	6,163		13	1	2	7,115
TOTAL NON-CHRISTIAN	12,615	6,376	23,271	157	154	39	17	42,629
INDEFINITE—								
Freethinker	1,976	1,294	18	10	69	4	9	3,380
Agnostic	1,824	1,259	58	9	48		10	3,208
No Denomination	2,129	602	10	3	15	. 4	3	2,766
Others	3,767	1,836	130	28	82	3	8	5,854
TOTAL INDEFINITE	9,696	4,991	216	50	214	11	30	15,208
NO RELIGION-		-						
No Religion	5,809	2,777	832	- 18	173	148	25	9,782
Atheist	325	232	26	ī	19	1	4	608
Others	109	80	3		2			194
TOTAL NO RELIGION	6,243	3,089	861	19	194	149	29	10,584
GRAND TOTAL	3,721,052	673,006	36,822	4,995	11,402	3,439	4,289	4,455,005

The succeeding table shews for each of the birthplaces specified the proportion per cent. of the total population who were adherents of the various religions.

Religion Percentage of Total Commonwealth Population for each Birthplace, 3rd April, 1911.

Religion.	Aus- tralasia.	Europe.	Asia.	Africa.	America	Poly- nesia.	At Sea.	Total.
CHRISTIAN—	%	0/_	0/_	0/2	0/,	0/2	%	<u>%</u>
Church of England	40.03	37.30	$\overset{\%}{14.83}$	$\overset{\%}{43.19}$	$\begin{array}{c} \% \\ 35.52 \end{array}$	$\substack{\%\\42.48}$	41.64	39.40
Presbyterian	12.66	14.57	2.90	10.71	13.12	11.72	14.80	12.86
Methodist	13.25	9.68	2.52	8.91	9.51	15.94	11.82	12.61
Baptist	2.20	2.51	.45	2.68	3.17	.26	2.17	2.24
Congregational	1.67	1.95	.27	1.80	1.82	3.23	1.66	1.71
Lutheran	1.39	3.37	.07	.70	1.06	.41	1.59	1.67
Church of Christ	.94	.67	.59	.84	.80	.87	1.07	.89
Salvation Army	.62	.59	.12	.42	.44	1.31	1.35	.61
Seventh Day Adventists	.14	.14	.05	.18	.82	.32	.19	.14
Unitarian	.03	.15	.03	.10	.32		.09	.05
Protestant (undefined)	2.23	4.27	.89	3.71	4.87	3.49	3.36	2.54
T		19.49		18.08	19.25	10.47	16.69	$\begin{array}{c} 2.34 \\ 21.22 \end{array}$
0 1 0 1 11	$\begin{array}{c} 21.68 \\ .01 \end{array}$	.30	$8.17 \\ .94$	.54	.08	.08	.05	.06
						1.57	1.12	
Catholic (undefined)	1.78	1.51	1.14	1.28	1.98	-		1.74
Others	.60	1.35	.89	2.34	2.31	2.06	.63	.72
TOTAL CHRISTIAN-	99.23	97.85	33.87	95.48	95.07	94.21	98.23	98.46
NON-CHRISTIAN-						<del></del>		
Hebrew	.30	.88	.62	2.54	1.17	.58	.28	.40
Confucian		.00	- 17.42	2.01	.01	•••	.02	.15
Mohammedan	]	i i	12.52	.58	.02	.03	• .05	.11
D 1111	} .02	.01	11.13	.02	.02	.00	.00	.10
Damam	[ <b>]</b>	1	4.77	.02	.02	.05		.04
Others	.02	.06	16.74		.11	.03	.05	.16
Total Non-Christian	.34	.95	63.20	3.14	1.35	1.14	.40	.96
INDEFINITE—							·	
T3 (1 : 1	.05	.19	.05	.20	.61	.12	.21	.08
A	.05	.19	.16	.18	.42		.23	.03
37° 30	.06					.12	.07	.06
0.0		.09	.03	.06	.13			
Others	.10	.27	.35	56	.72	.08	.19	.13
Total Indefinite	.26	.74	.59	1.00	1.88	.32	.70	.34
NO RELIGION-								
No Religion	.16	.41	2.26	.36	1.52	4.30	.58	.22
Atheist	1	1	.07	.02	.16	.03	.09	.01
Others	.01	.05	.01		.02			.01
TOTAL NO RELIGION	.17	.46	2.34	.38	1.70	4.33	.67	.24
		1					1	

12. Australasian-born Population.—As already noted, the Australasian-born population of the Commonwealth, comprising those born in Australia and New Zealand, numbered 3,721,052, and represented no less than  $83\frac{1}{2}\%$  of the total population. Of these 3,688,935 were Australian-born, of whom 1,850,952 were males, and 1,837,983 females. The remaining 32,117 had been born in New Zealand, and comprised 16,998 males and 15,119 females.

The following table furnishes particulars concerning the interchange of Australasianborn population between Australia and New Zealand as indicated by the Censuses of 1891, 1901 and 1911.

Native-born Population of Australasia, 1891, 1901 and 1911.

BIRTHPLACE.	Number resident in-								
	AUSTRALIA.			NEW ZEALAND.			Australasia.		
	Males.	Females.	Persons.	Males.	Females.	Persons.	Males.	Females.	Persons.
				CENSUS	OF 1891.			,	
Australia New Zealand	1,090,521 1 <b>2,</b> 939	1,075,682 11,011	2,166,203 23,950	7,692 183,965	8,276 183,338	15,968 367,303	1,098,213 196,904	1,083,958 194,349	2,182,171 391,253
Australasia	1,103,460	1,086,693	2,190,153	191,657	191,614	383,271	1,295,117	1,278,307	2,573,424

	Native-born	Population	οf	Australasia-	continued.
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				Numbi	ER RESIDEN	IT IN—			
BIRTHPLACE.		Australia	<u> </u>	Nı	EW ZEALAN	m.		AUSTRALAS	IA.
	Males.	Females.	Persons.	Males.	Females.	Persons.	Males.	Females.	Persons.
				CENSUS	OF 1901.				
Australia New Zealand	1,460,602 13,600	1,453,882 12,242	2,914,484 25,842	14,244 258,020	12,763 258,377	27,007 516,397	1,474,846 271,620	1,466,645 270,619	2,941,491 542,239
Australasia	1,474,202	1,466,124	2,940,326	272,264	271,140	543,404	1,746,466	1,737,264	3,483,730
	-1,			CENSUS (	OF 1911.		· <del>-</del>		
Australia New Zealand		1,837,983 15,119	3,688,935 32,117	28,031 352,497	22,037 350,821	50,068 703,318	1,878,983 369,495	1,860,020 365,940	3,739,003 735,435
Australasia	1,867,950	1,853,102	3,721,052	380,528	372,858	753,386	2,248,478	2,225,960	4,474,438

In this table the figures for persons resident in New Zealand, as well as for those resident in Australia, have been adjusted to allow for persons of unspecified birthplace.

It will be seen that the number of Australian-born persons resident in New Zealand had, at the date of the last Census, grown to a figure considerably in excess of the number of New Zealand-born persons resident in Australia, the respective figures being 50,068 Australian-born persons resident in New Zealand, as compared with 32,117 New Zealand-born persons resident in Australia. On the other hand, the proportion of native-born New Zealanders resident in Australasia but outside their land of birth, is much greater than is the case for the Australians similarly situated. Such proportions for New Zealand are 6.12 per cent. in 1891, 4.77 per cent. in 1901 and 4.37 per cent. in 1911. While for Autralians the corresponding proportions are 0.73 per cent. in 1891, 0.92 per cent. in 1901 and 1.34 per cent. in 1911.

While these figures indicate a greater proportionate tendency for New Zealanders to migrate to Australia than for Australians to migrate to New Zealand, they also indicate a progressively diminishing tendency for New Zealanders, and a progressively increasing tendency for Australians to so migrate.

In the foregoing table and calculations based thereon Maoris and full-blooded Australian Aboriginals have been left out of account.

13. Native-born Population.—(i.) General View.—At the Census of 3rd April, 1911, more than  $82\frac{3}{4}$  per cent. of the total population of the Commonwealth claimed Australia as their birthplace. Of the persons resident in the several States and Territories the proportions native-born were as follows:—New South Wales, 84 per cent.; Victoria,  $84\frac{3}{4}$  per cent.; Queensland,  $74\frac{1}{2}$  per cent.; South Australia, 86 per cent.; Western Australia,  $74\frac{1}{2}$  per cent.; Tasmania,  $91\frac{1}{2}$  per cent.; Northern Territory,  $45\frac{3}{4}$  per cent.; Federal Territory, 88 per cent. The birthplaces which contributed most largely to the Australian-born total were New South Wales and Victoria, which between them accounted for upwards of two-thirds of the total. New South Wales provided 1,341,522, and Victoria 1,206,298 out of a total of 3,688,935 Australian-born. In this section persons recorded as having been born in the Northern Territory have been classed to South Australia, and those born in the Federal Territory have been classed to New South Wales. Particulars in respect to each State as birthplace are given in the succeeding table:—

Native-born Population of the Commonwealth, 3rd April, 1911.

				Persons.		Masculinity. (Excess of males over
Birthplace.	Males.	Females.	Number.	Percentage on total Australian- born.	Percentage on total population.	females per 100 of sexes combined).
New South Wales <sup>1</sup> Victoria Queensland South Australia <sup>2</sup> Western Australia Tasmania	674,145 603,809 212,382 202,581 58,839 99,196	667,377 602,489 210,694 201,151 57,630 98,642	1,341,522 1,206,298 423,076 403,732 116,469 197,838	% 36.37 32.70 11.47 10.94 3.16 5.36	% 30.11 27.08 9.50 9.06 2.61 4.44	.50 .11 .40 .35 1.04
Total	1,850,952	1,837,983	3,688,935	100.00	82.80	.35

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

(ii.) Figures for Previous Censuses.—The Census of 1891 was the first at which full details were published by all the States in respect of the birthplaces of the Australian-born population. In two cases for 1881 the published figures shew separately only the number born in the State of enumeration, those born in other States of Australia being included with particulars for other birthplaces. In view, however, of the fact that the number so included was relatively small, a fairly reliable estimate can be made of the number of Australian-born resident in the Commonwealth at the Census of 1881. The figures so obtained have been combined, in the attached comparative table, with those for the Censuses of 1891, 1901 and 1911.

Native-horn	Population	of the	Commonwealth.	1 881	to 1911
TAUTAG-DOIT	TODUMANON	or me	COMMITTOR CAREMY	TOOT	M TATT

						Pers	ons.	Masculinity. (Excess of males over
Date of	f Cens	us.	and the second s	Males.	Females.	Number.	Percentage on total population.	females per 100 of sexes combined).
3rd April, 1881 5th April, 1891 31st March, 1901 3rd April, 1911				714,180 1,090,521 1,460,602 1,850,952	708,545 1,075,682 1,453,882 1,837,983	1,422,725 2,166,203 2,914,484 3,688,935	63.23 68.24 77.23 82.80	.40 .69 .23 .35

The increases in the number of native-born residents of the Commonwealth during the three decennial periods under review are as follows:—

Increases in Native-born Population of the Commonwealth, 1881 to 1911.

	Males.		LES.	FE	MALES.	s. Persons.		
PE	RIOD.		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
1881–1891			376,341	52.70	367,137	51.82	743,478	52,26
1891-1901			370,081	33.94	378,200	35.16	748,281	34.54
1901-1911			390,350	26.73	384,101	26.42	774,451	26.57

It will be seen that whilst in the case of females the increase in the number of the native-born population progressively increased during the three decennia under review, that for males fell in 1891-1901, and rose again in the succeeding decennium. This latter result was due mainly to two causes: (i.) The financial crisis and resultant commercial distress of the early "nineties," and (ii.) the outbreak of the South African War in the late "nineties." Each of these causes was responsible for the exodus from Australia of some of her native-born males.

A comparison of the numbers born in each State who were resident in the Commonwealth at the Censuses of 1881, 1891, 1901 and 1911, is furnished by the following table:—

Native-born Population of the Commonwealth, 1881 to 1911.

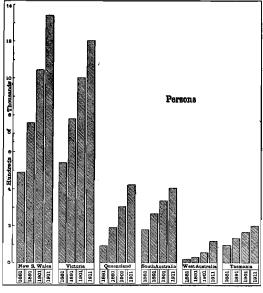
7		Per	sons.			centag ıstrali					e on t hplace	
Birthplace.	1881.	1891.	1901.	1911.	1881.	1891.	1901.	1911.	1881.	1891.	1901.	1911.
New South Wales	1 401 000	#6# F91	1.040.400	1 041 700	1 %	   %0		% or	% 21.86	% 190	% 	%   %
¥7: -4: -		767,531	1,046,403									
	542,315	779,890	1,004,657	1,206,298					24.10			
Queensland	93,599	191,097	306,118					11.47				
South Australia 2	178,103	265,178	336,989	403,732	12.52	12.24	11.56	10.94	7.92	8.35	8.93	-9.06
Western Australia	19,099	29,834	56.374	116.469	1,34	1.38	1.94	3.16	.85	.94	1.49	2.61
Tasmania	97,621	132,673	163,943	197,838	6.86	6.13	5.63	5.36	4.34	4.18	4.35	4.44
Australia	1,422,725	2,166,203	2,914,484	3,688,935	100.00	100.00	100.00	100.00	63.23	68.24	77.23	82.80

<sup>&</sup>lt;sup>1</sup> Including Federal Territory. <sup>2</sup>

<sup>&</sup>lt;sup>2</sup> Including Northern Territory,

The proportion which those born in a State represented of the total native-born population increased between 1881 and 1911 in the cases of New South Wales, Queensland and Western

# Native-born Population according to States of Birth.



GRAPH No. 28.

Australia, but diminished in the cases of Victoria, South Australia and Tasmania. In all cases the proportion which those born in a State represented of the total Commonwealth population increased during the period under review.

The accompanying graph (No. 28) furnishes a comparative view of the number of persons recorded at each of the last four Censuses of Australia, who had been born in each of the States, and were resident in Australia at the dates of the several Censuses.

(iii.) Interstate Migration of the Nativeborn.—It is somewhat widely supposed that the native-born Australian has inherited from his immigrant forbears a tendency to rove, and that he is in consequence little disposed to remain in one place. Such an idea would appear to be supported by the Census results, which shew a large proportion of the native-born resident in other States than those in which they had been born.

The succeeding table gives the number for each sex and for the sexes combined who were born in each of the States, and were, at the date of the last Census, resident in one or other of the States of the Commonwealth.

Native-born Population of Australia, according to State of Birth and State of Residence, 3rd April, 1911.

		State	IN WHICH	RESIDENT.			
BIRTHPLACE.	N.S.W.1	Vic.	Q'land.	S.A. <sup>2</sup>	W.A.	Tas.	Total.
			MALES.				
New South Wales <sup>1</sup>	621,486	13,573	24,171	4,042	9,798	1,075	674,145
Victoria	43,130	506.333	10,590	7,741	31,377	4,638	603,809
Queensland	12,130	2,199	195,200	612	2,055	186	212,382
South Australia <sup>2</sup>	13,304	11,804	2,196	161,232	13,593	<b>452</b>	202,581
Western Australia	1,277	2,291	257	1,303	53,594	117	58,839
Tasmania	5,354	9,231	1,247	656	1,567	81,141	99,196
Commonwealth	696,681	545,431	233,661	175,586	111,984	87,609	1,850,952
		F	EMALES.				
New South Wales <sup>1</sup>	623,610	15,813	15,203	3,739	7,729	1,283	667,377
Victoria	34,642	526,888	5,503	7,159	24,069	4,228	602,489
Queensland	13,542	3,026	191,616	464	1,792	254	210,694
South Australia <sup>2</sup>	11,430	12,461	1,224	164,291	11,260	485	201,151
Western Australia	1,254	2,350	230	1,344	52,324	128	57,630
Tasmania	5,253	11,254	585	624	1,119	79 ,807	98,642
Commonwealth	689,731	571,792	214,361	177,621	98,293	86,185	1,837,983
		P	ERSONS.				
New South Wales <sup>1</sup>	1,245,096	29,386	39,374	7,781	17,527	2,358	1,341,522
Victoria		1.033.221	16,093	14,900	55,446	8.866	1,206,298
Queensland	0-10-0	5,225	386.816	1,076	3,847	440	423,076
South Australia <sup>2</sup>	04,504	24,265	3,420	325,523	24,853	937	403,732
Western Australia	0,-01	4,641	487	2,647	105,918	245	116,469
Tasmania	70'00-	20,485	1,832	1,280	2,686	160,948	197,838
Commonwealth	1,386,412	1,117,223	448,022	353,207	210,277	173,794	3,688,935

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

The proportion per cent. of the population born in each State who were resident in the several States is furnished in the following table.

Proportional Distribution according to Residence of Population Born in each State (Sexes combined).

		STATE	IN WHICH	RESIDENT.			
BIRTHPLACE.	N.S.W.1	Vie.	Q'land.	S.A. <sup>2</sup>	W.A.	Tas.	TOTAL.
	%	%	%	%	%	%	%
New South Wales <sup>1</sup>	92.81	$\overset{\%}{2.19}$	% 2.93	~	$\overset{\%}{1.31}$	´.18	100.00
Victoria	6.45	85.65	1.33	1.24	4.60	.73	100.00
Queensland	6.07	1.24	91.43	.25	.91	.10	100.00
South Australia <sup>2</sup>	6.13	6.01	.85	80.63	6.15	.23	100.00
Western Australia	2.17	3.99	.42	2.27	90.94	.21	100.00
Tasmania	5.36	10.35	.93	.65	1.36	81.35	100.00
Commonwealth	37.58	30.29	12.15	9.57	5.70	4.71	100.00

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

The preceding table indicates that New South Wales had the highest proportion of those born within her boundaries still resident therein at the date of the Census, while South Australia had the lowest proportion so resident, the respective percentages being 92.81 for New South Wales, and 80.63 for South Australia. This table furnishes an indication of the extent and direction of the outflow of population from the State of birth.

The proportion per cent. of the Australian-born population resident in each State who had been born in the several States of the Commonwealth, is as follows:—

Proportional Distribution according to Birthplace of Australian-born Residents in each State (Sexes combined).

		Sa	TATE IN WHI	CH RESIDE	NT.	İ	
BIRTHPLACE.	N.S.W.1	Vic.	Q'land.	S.A.2	W.A.	Tas.	C'wlth
New South Wales 1 Victoria Queensland South Australia 2 Western Australia Tasmania	89.81 5.61 1.85 1.78 .18	2.63 <b>92.48</b> .47 2.17 .42 1.83	%.79 3.59 <b>86.34</b> .76 .11 .41	% 2.20 4.22 .31 <b>92.16</b> .75 .36	% 8.34 26.37 1.82 11.82 <b>50.37</b> 1.28	% 1.36 5.10 .25 .54 .14 <b>92.61</b>	36.37 32.70 11.47 10.94 3.16 5.36
Commonwealth	100.00	100.00	100.00	100.00	100.00	100.00	100.00

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

This table furnishes an indication of the extent and direction of inflow of population to each State. This inflow was proportionately greatest in Western Australia, where only 50.37 per cent. of the Australian-born population were natives of that State, and proportionately least in Tasmania, where 92.61 per cent. of the Australian-born population had been born in Tasmania.

An interesting view of the effect of the migration of the native-born is given in the following table, which shews for any given State the difference between the number born in other States who were resident in that State, and the number born in that State who were resident in other States.

Net Migration of Native-born as at 3rd April, 1911.

State from			-				enced net gr $+$ ; loss b		
gain or loss population				N.S.W.1	Vic.	Q'land.	S.A. 2	W.A.	Tas.
New South Wale	es¹			• •	<b>— 48,386</b>	+13,702	16,953	+ 14,996	
Victoria				+48,386		+10,868	9,365	+ 50,805	11,619
Queensland				<b>— 13,702</b>	10,868		2,344	+ 3,360	- 1,392
South Australia <sup>2</sup>				+16,953	+ 9,365	+ 2,344		+22,206	<b>343</b>
Western Austral	ia			-14,996	50,805	- 3,360	22,206		<b>— 2,441</b>
Tasmania		• •	• •	+ 8,249	+ 11,619	+ 1,392	+ 343	+ 2,441	
TOTAL	• •			+ 44,890	89,075	+ 24,946	50,525	+ 93,808	24,044

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

The State with the greatest net gain was Western Australia, the total being 93,808, while Victoria, with a total of 89,075, was the greatest net loser. Western Australia was the only State which exhibited a net gain from all the other States, whilst Tasmania was the only State which had experienced a net loss to all the others. Of the rest, Queensland gained from all except Western Australia, and South Australia lost to all except Tasmania, while New South

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

Wales gained from all except Western Australia and Queensland, and Victoria lost to all except Tasmania and South Australia. The largest net gains by one State from another were (i.) a gain of 50,805 by Western Australia from Victoria; (ii.) a gain of 48,386 by New South Wales from Victoria; (iii.) a gain of 22,206 by Western Australia from South Australia; and (iv.) a gain of 16,953 by New South Wales from South Australia.

The net gains or losses in each of the States, as at the Censuses of 1881, 1891, 1901 and 1911, are as follows:—

Net Migration of Native-born, 1881 to 1911.

				NET	Gain +.	NET Loss	
STATE.				1881.	1891	1901.	1911.
New South Wales <sup>1</sup>				$+\ 15,721$	+ 34,228	+ 33,887	+ 44,890
Victoria	• •			<b>3,307</b>	+ 5,323	59,782	89,075
Queensland				+ 7,221	+13,282	+17,531	+24,946
South Australia <sup>2</sup>		٠.		5,160	<b>→ 36,</b> 070	46,786	<b>—</b> 50,525
Western Australia				770	+ 1.129	+ 70,738	+ 93,808
Tasmania				13,705	<b>— 17,892</b>	15,588	- 24.044

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

It will be seen from this table that throughout the period from 1881 to 1911, New South Wales and Queensland have experienced a net gain of native-born population, while South Australia and Tasmania have throughout experienced a net loss. Western Australia exhibited a net gain at all Censuses except that of 1881, while Victoria exhibited a net loss at all Censuses except that of 1891. The largest net gain shewn at the different Censuses were those of New South Wales in 1881 and 1891, and those of Western Australia in 1901 and 1911, while the largest net losses have been shewn by Tasmania in 1881, South Australia in 1891, and Victoria in 1901 and 1911.

A comparison for the Censuses of 1881 to 1911 of the number and proportion of the persons born in each of the States, who were resident in other States than that of birth, gives a good indication of the strength of the tendency on the part of the native-born to migrate to other States, and of the variations of this tendency during the past thirty years.

Residence in other States than that of Birth, 1881 to 1891. 3RD APRIL, 1911. 3RD APRIL, 1881. 5TH APRIL, 1891. 31st Mar., 1901. Number Number Number Number residentresidentProresidentProresidentPro-Pro-BIRTHPLACE. portion portion in other in other in other in other portion portion States States per cent. States per cent. per cent. States per cent. than that than that than that than that resident. in which resident. in which resident. in which resident. in which born. born. born. born. MALES. % 5.74 8.74 7.01 % 4.88 7.71 7.87 % 7.81 16.14 7.1014.18 37,307 71,220 52,659 97,476 New South Wales<sup>1</sup> 12,082 22,179 34,257 6,732 Victoria 20.951 6.7817,182 Queensland 3,736 10,408 8.09 ٠. 34,478 1,764  $20.42 \\ 6.22$ 41,349 5,245 South Australia<sup>2</sup> 7,304 8.18 25,110 18.7520.41 Western Australia 659 6.89 962 6.37 8.91 12,957 Tasmania 8,597 17.65 11,957 17.91 15.75 18,055 18.20 53,329 11.51 231,966 12.53 COMMONWEALTH 101,197 9.28 168,134 7.47 FEMALES. 43,767 6.56 New South Wales1 10.597 4.34 18,735 4.92 30.468 5.85 75,601 Victoria 15,924 5.88 25,985 6.70 53,075 10.57 12.55 . . 9.05 18.32 Queensland 3,420 7.41 7,043 7.41 11,113 7.2919,078 South Australia<sup>2</sup> 6,948 7.82 21,480 16.36 29,207 17.37 36.860 9.21 5,306 Western Australia 1.851 648 6.79 984 6.61 6.68 12,297 18,835 19.09 Tasmania 17.86 18.65 199,447 10.85 46,273 86.524 8.04 139,672 9.61 COMMONWEALTH 6.53 PERSONS. 22,679 New South Wales<sup>1</sup> 40.914 96,426 4.61 67,775 7.19 5.33 6.48 124,295 21,521 7.72 12.37 Victoria 36,875 6.80 60,242 173,077 14.35 . . 36,260 78,209 Queensland 7,156 7.65 13,775 7.21 7.03 8.57 South Australia2 14.252 46,590 17.57 19.37 8.00 63.685 18.90 Western Australia 1,307 6.84 1,946 6.52 3.615 6.41 10,551 9.06 36,890 18.65 Tasmania 17,333 17.76 24,254 18.28 26,915 16.42COMMONWEALTH 99,602 7.00 187,721 307,806 10.56 431,413 11.69 8.67

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

This table furnishes evidence of the increasing tendency for persons born in one State to migrate to other States of the Commonwealth. Thus, whilst at the Census of 1881 seven per cent. of the native-born population were resident in States other than that of birth, the corresponding percentage in 1891 was 8.67, in 1901 it was 10.56, and in 1911 it was 11.69. The percentage has throughout been somewhat less for females than for males, but a similar tendency to increase is in evidence in both sexes. The totals disclose the fact that 173,077 persons born in Victoria, 96,426 born in New South Wales, and 78,209 born in South Australia were at the date of the last Census resident in States other than that of birth, and that the same relative positions were occupied by these States in this respect at the Census of 1901. In 1891 South Australia was second and New South Wales was third, while in 1881 Tasmania occupied third place, South Australia being fourth.

(iv.) Native-born Metropolitan Population.—The following table shews the extent to which the population born in the several States was resident in the various Metropolitan areas at the date of the Census.

Native-born Metropolitan Population according to State of Birth, 3rd April, 1911.

Birthplace.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan
			MALES.		l		
New South Wales <sup>1</sup>	209,082	6,320	3,470	2,126	3,259	400	224,657
Victoria	12,401	204,691	1,538	4,237	10,151	700	233,718
Queensland	5,358	1,213	41,627	249	659	51	49,157
South Australia 2	2,204	4,429	261	66,166	3,813	85	76,958
Western Australia	611	1,241	63	780	19,669	25	22,389
Tasmania	2,620	5,187	191	398	455	14,920	23,771
Commonwealth	232,276	223,081	47,150	73,956	38,006	16,181	630,650
	<u> </u>	]	FEMALES.				
New South Wales <sup>1</sup>	238,495	8,605	3,650	2,291	3,541	498	257,080
Victoria	14,438	236,090	1,394	4,478	11,385	909	268,694
Queensland	6,878	1,654	46,278	262	763	85	55,920
South Australia <sup>2</sup>	2,547	5,826	252	76,045	4,536	113	89,319
Western Australia	638	1,327	78	850	21,352	47	24,292
Γasmania	3,577	7,497	186	425	539	17,644	29,868
Commonwealth	266,573	260,999	51,838	84,351	42,116	19,296	725,173
			PERSONS	•		to-	
New South Wales <sup>1</sup>	447,577	14,925	7.120	4.417	6,800	898	481,737
Victoria	26,839	440,781	2,932	8,715	21,536	1,609	502,412
Queensland	12,236	2,867	87,905	511	1,422	136	105,077
South Australia	4,751	10,255	513	142,211	8,349	198	166,277
Western Australia	1,249	2,568	141	1,630	41,021	72	46,681
fasmania	6,197	12,684	377	823	994	32,564	53,639
Commonwealth	498,849	484,080	98,988	158,307	80,122	35,477	1,355,823

<sup>&</sup>lt;sup>1</sup> Including Federal Territory. <sup>2</sup> 1

In the next table is shewn for each birthplace the proportion per cent. which those resident in the Metropolis of each State were of the total for that birthplace resident in that State.

Proportion per cent. of Native-born Resident in Metropolitan Areas, 3rd April, 1911.

		STATE IN WHICH RESIDENT.											
BIRTHPLACE.	N.S.W.1	Vic.	Q'land.	S.A. 2	W.A.	Tas.	C'wlth.						
MALES.													
N. C. 41 M. 11	%,	%	%	-% - %	9004	%	%						
New South Wales <sup>1</sup>	33.64	46.57	14.35	52.60	33.24	37.21	33.32						
Victoria	28.49	40.46	14.51	54.73	32.33	15.10	$38.71 \\ 23.15$						
Queensland South Australia <sup>2</sup>	47.39	60.38	21.21	40.75	$\frac{32.07}{28.11}$	$27.42 \\ 18.85$	37.99						
TTT 1 A 1 11	16.56	37.89	11.87	41.00	36.70	$\begin{array}{c} 15.55 \\ 21.55 \end{array}$	38.05						
Western Australia	47.92	54.24	24.51	59.91	31.97	18.28	23.96						
Tasmania	48.91	58.45	15.30	60.58	31.97	18.28	23.90						
Commonwealth	33.36	40.98	20.09	42.09	33.98	18.37	34.07						
			FEMALES.										
New South Wales <sup>1</sup>	38.25	54.42	23.99	61.29	45.79	38.85	38.52						
Vietoria	40.74	44.88	$\begin{array}{c} 25.99 \\ 25.31 \end{array}$	62.57	47.29	21.50	44.60						
Queensland	54.48	65.40	23.96	56.71	44.83	33.60	26.54						
Cl + 1: A c + 1: - 9	22.28	46.79	20.57	46.29	40.26	23.30	44.40						
Western Australia	50.88	56.47	34.06	63.24	40.81	36.72	42.15						
Tasmania	68.06	69.71	31.79	68.00	48.13	21.97	30.28						
Commonwealth	38.66	45.79	24.01	47.49	42.88	22.26	39.45						

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

Proportion per cent. of Native-born Resident in Metropolitan Area—continued.

	STATE IN WHICH RESIDENT.								
BIRTHPLACE.	N.S.W.1	Vie.	Q'land.	S.A. 2	W.A.	Tas.	C'wlth.		
			PERSONS.						
New South Wales¹ Victoria	35.95 33.98 51.13 19.20 49.39 58.39	50.79 42.71 63.18 42.48 55.37 64.62	18.07 18.21 22.58 14.99 29.01 20.57	56.77 58.50 47.62 43.67 61.60 64.20	38.77 38.82 37.85 33.62 38.73 39.09	38.10 18.16 30.98 21.15 29.51 20.11	35.91 41.65 24.84 41.18 40.08 27.11		
Commonwealth	36.00	43.44	21.97	44.80	38.14	20.30	36.75		

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

These figures indicate that of the Australian-born residents of other States than that of birth, those born in South Australia shewed the least marked tendency to aggregate in Metropolitan areas, while those born in Tasmania exhibited the tendency to the most marked extent. This will perhaps be better seen from the following table.

Metropolitan Numbers and Proportions of Native-born (Sexes Combined), 3rd April, 1911.

	TTO DILIMINA	n-born Popui in State of		Australian-born Population resident in other States than that of birth.			
BIRTHPLACE.	Metro- politan Area.	Total.	Percentage of Metro- politan on Total.	Metro- politan Areas.	Total.	Percentage of Metro- politan on Total.	
New South Wales Victoria Queensland South Australia Western Australia Tasmania	447,577 440,781 87,905 142,211 41,021 32,564	1,245,096 1,033,221 386,816 325,523 105,918 160,948	35.95 42.66 22.73 43.69 38.73 20.23	34,160 61,631 17,172 24,066 5,660 21,075	96,426 173,077 36,260 78,209 10,551 36,890	35.43 35.61 47.36 30.77 53.64 57.13	
Total	1,192,059	3,257,522	36.59	163,764	431,413	37.96	

It will be seen that taking Australia as a whole, 36.59 per cent. of those remaining in their State of birth were residents of Metropolitan areas, while 37.96 per cent. of those resident

in other States than that of birth were living in Metropolitan areas.

(v.) Ages of the Native-born.—In the following table are given particulars concerning the ages of the native-born population of Australia at the date of the Census, the figures being separately given for each sex in respect of each State of birth.

Native-born Male Population of the Commonwealth in Ages, 3rd April, 1911.

			·	STATE	IN WHICH	BORN.			<u>.</u>
AGE LAST I	SIRTHD A	Y.	N.S.W.1	Vic.	Q'land.	S.A. <sup>2</sup>	W.A.	Tas.	TOTAL.
0			22,947	15,913	8,262	5,336	3,784	2,793	59,035
ĭ			20,607	14,840	7,646	4,939	3,503	2,576	54,111
$\overline{2}$	• •		19,299	14,087	6,817	4,679	3,458	2,528	50,868
3			19,192	14,227	6,910	4,411	3,499	2,544	50,783
4			18,830	13,820	6,732	4,202	3,461	2,477	49,522
5-9			83,027	65,255	30,462	20,171	14,261	11,763	224,939
0-14			77,290	64,362	30,212	20,118	9,332	10,423	211,737
5-19			80,440	71,849	30,318	22,343	4,275	10,583	219,808
20-24			75,780	66,147	27,450	22,372	3,154	9,734	204,637
25-29			61,108	52,526	18,631	22,252	2,237	8,177	164,931
30-34	• •		47,750	46,940	13,528	17,580	1,889	6,340	134,027
35–39		• •	38,952	44,732	10,484	13,645	1,648	5,798	115,259
10-44			33,335	42,203	7,946	12,736	1,408	5,594	103,222
15–49			26,249	36,393	4,145	10,557	1,134	5,442	83,920
50-54			19,264	25,962	1,778	8,230	792	4,672	60,698
55–59			11,735	9,909	668	5,069	494	2,987	30,862
60-64	• •		8,406	2,856	264	2,502	248	1,995	16,271
65–69		• •	6,304	1,437	86	1,086	158	1,453	10,524
70-74			2,338	253	21	316	65	785	3,778
75 and over			1,292	98	22	37	39	532	2,020
TOTAL			674,145	603,809	212,382	202,581	58,839	99,196	1,850,952

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

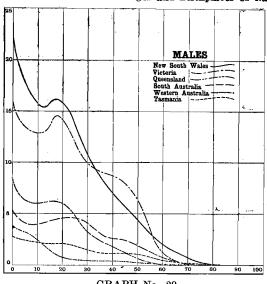
Similar particulars in respect of the native-born female population are furnished in the succeeding table.

Native-born Female Population of the Commonwealth in Ages, 3rd April, 1911.

<b>А</b> ста т	A CITTI	Віктно	437			STATE IN W	HICH BORN.			m
AGE L	<b>TO1</b>	DIKIND	A1.	N.S.W.1	Vic.	Q'land.	S.A. 2	W.A.	Tas.	Total.
0				22,102	15,099	7,945	5,103	3,666	2,606	56,521
1				19,890	14,321	7,274	4,750	3,482	2,537	52,254
2	٠.			19,001	13,254	6,564	4,462	3,418	2,467	49,166
3				18,923	13,921	6,532	4,401	3,370	2,387	49,534
4				17,925	13,605	6,416	4,199	3,258	2,409	47,812
5-9				81,293	63,414	29,941	19,534	13,882	11,199	219,263
10-14	٠.			76,255	63,210	30,057	19,910	9,159	9,900	208,491
15 - 19				79,654	71,463	30,034	22,565	4,351	10,425	218,492
20 - 24	٠.			77,231	67,826	28,331	22,618	3,174	10,200	209,380
25 - 29				62,790	54,813	19,038	22,522	•2,127	8,673	169,963
30-34				47,937	49,288	13,842	17,661	1,867	6,863	137,458
35 - 39	٠.			38,758	45,884	10,442	13,749	1,594	5,771	116,198
40-44				31,608	41,857	7,626	12,436	1,411	5,477	100,415
45 - 49	٠.			25,000	35,512	3,924	10,311	1,106	5,277	81,130
<b>50–54</b>				18,562	24,970	1,680	8,037	777	4,509	58,535
<b>55–59</b>				11,435	9,376	687	5,050	459	2,837	29,844
60-64				8,489	2,834	240	2,409	249	2,018	16,239
65 - 69				6,527	1,525	79	1,092	176	1,602	11,001
70-74				2,595	222	31	299	58	868	4,073
75 and	over	•••	• •	1,402	95	11	43	46	617	2,214
To	'AL			667,377	602,489	210,694	201,151	57,630	98,642	1,837,983

<sup>1</sup> Including Federal Territory. <sup>2</sup> Including Northern Territory.

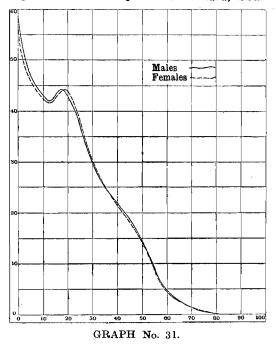
Ages and Birthplaces of Native-born Population, 1911.





GRAPH No. 30.

## Ages of Native-born Population of Australia, 1911.



The accompanying graphs (Nos. 29 and 30) furnish a representation of the numbers at each age who had been born in each of the States. The base of each small rectangle represents 10 years of age and the height The similarity of the male 5000 persons. and female curves for each State is very marked. It is also of interest to note the pairing of the curves, viz., (i.) New South Wales with Victoria, (ii.) Queensland with South Australia, and (iii.) Western Australia with Tasmania. In each case the curve for the former State commences at a higher point than that for the latter, and subsequently crosses it; the New South Wales curves crossing those for Victoria between ages 30 and 40, Queensland crossing South Australia between 20 and 30, and Western Australia crossing Tasmania between 10 and 20.

Graph No. 31 furnishes a representation of the numbers of native born males and females of each age who were resident in Australia at the Census of 1911. The base of each small square represents 10 years of age, and the height 5000 persons. It will be seen that the male and female curves are very similar in form, the slight excess of males at

early ages being due to the usual preponderance of male births and the slight excess of females in early adult ages being due mainly to male emigration.

For the sexes in combination the figures are as follows:—

Total Native-born Population of the Commonwealth in Ages, 3rd April, 1911.

AGE LA	ST B	IBTED	A W		S	TATE IN W	HICH BORN.			
				N.S.W.1	Vie.	Q'land.	S.A. 2	W.A.	Tas.	Total.
0				45,049	31,012	16,207	10,439	7,450	5,399	115,556
1				40,497	29,161	14,920	9,689	6,985	5,113	106,365
2	• •	• •		38,300	27,341	13,381	9,141	6,876	4,995	100,303
3				38,115	28,148	13,442	8,812	6,869	4,931	100,034
_ 4	• •			36,755	27,425	13,148	8,401	6,719	4,886	97,334
5-9	• •			164,320	128,669	60,403	39,705	28,143	22,962	$\frac{97,334}{444,202}$
10–14	• •			153,545	127,572	60,269	40,028	18,491	20,323	420,228
15-19	• •			160,094	143,312	60,352	44,908	8,626	21,008	438,300
20-24				153,011	133,973	55,781	44,990	6,328	19,934	414,017
2529				123,898	107,339	37,669	44,774	4,364	16,850	334,894
30–34				95,687	96,228	27,370	35,241	3,756	13,203	271,485
35–39				77,710	90,616	20,926	27,394	3,242	11,569	
40 - 44				64,943	84,060	15,572	25,172	2,819	11,071	231,457
45-49			٠.	51,249	71,905	8,069	20,868	2,240	10,719	203,637
50 - 54	٠.			37,826	50,932	3,458	16,267	1,569	9,181	165,050
55-59			٠.	23,170	19,285	1,355	10,119	953	5,824	119,233
60–64		ψ.		16,895	5,690	504	4,911	497	$\frac{3,824}{4.013}$	60,706
65-69				12,831	2,962	165	2,178	334		32,510
70–74				4,933	475	52	615	123	3,055	21,525
75 and o	ver	• •	٠.	2,694	193	33	80	85	$1,653 \\ 1,149$	7,851 4,234
Тота	L_	<u></u>	· ·	1,341,522	1,206,298	423,076	403,732	116,469	197,838	3,688,935

<sup>1</sup> Including Federal Territory. <sup>2</sup> Including Northern Territory.

The proportion of the native-born in the several quinquennial age groups is shewn in the attached table.

Proportion per cent. of Native-born Population of Australia in Successive Age Groups, 3rd April, 1911.

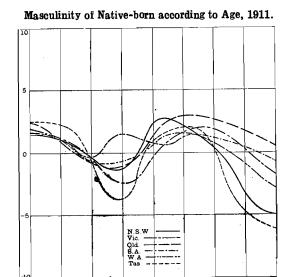
Age 1	LAST :	BIRTHD	AΨ.		S	STATE IN WI	HICH BORN.			_
				N.S.W.1	Vie.	Q'land.	S.A. 2	W.A.	Tas.	TOTAL.
0–4				.%.	%	%	%	%	%	- %
5-9	• •	• •	• •	14.81	11.86	16.80	11.51	29.96	12.80	14.09
3–3 10–14	• •	• •	• •	12.25	10.67	14.28	9.83	24.16	11.61	12.04
10–14 15–19	• •	• •	• •	11.44	10.57	14.25	9.91	15.88	10.27	11.39
	• •	• •		11.93	11.88	14.26	11.12	7.41	10.62	11.88
20-24	• •	• •		11.41	11.11	13.18	11.14	5.43	10.08	11.22
25-29	• •			9.24	8.90	8.90	11.09	3.75	8.52	9.08
30-34	٠.			7.13	7.98	6.47	8.73	3.22	6.67	7.36
35-39	٠.	• •		5.79	7.51	4.95	6.79	2.78	5.85	6.28
10-44	• •			4.84	6.97	3.68	6.24	2.42	5.60	5.52
5-49		• •		3.82	5.96	1.91	5.17	1.92	5.42	4.47
50–54	• •			2.82	4.22	.82	4.03	1.35	4.64	3.23
55–59				1.73	1.60	.32	2.51	.82	2.94	1.65
60-64	٠.	٠.		1.26	.47	.12	1.22	.43	2.03	
5 <b>5–6</b> 9				.96	.24	.04	.54	.29	1.54	.88
70–74	٠.			.37	.04	.01	.15	.11	.83	.58
5 and	over	• •	• • •	.20	.02	.01	.02	.07	.58	$.21 \\ .12$
To	TAL			100.00	100.00	100.00	100.00	100.00	100.00	100.00

<sup>1</sup> Including Federal Territory. <sup>2</sup> Including Northern Territory.

The following table, which shews for each age group the excess of males over females per 100 of the sexes combined, furnishes an interesting view of the relative numbers of males and females at different ages amongst the native-born population.

Masculinity of Native-born Population of the Commonwealth. (Excess of Males over Females per 100 of the Sexes combined), 3rd April, 1911.

AGE LAST	BIRTHD	AV.		1	STATE IN W	HICH BORN.			<b>A.</b>
			N.S.W.1	Vie.	Q'land.	S.A. 2	W.A.	Tas.	C'WLTH.
0-4			1.53	1.88	2.30	1.40	1.46	2.02	1.74
<b>5</b> –9			1.06	1.43	.86	1.60	1.35	2.46	1.28
.0–14			.67	.90	.26	.52	.94	2.57	
5-19			.49	.27	.47	49	88		.77
0-24			95	-1.25	-1.58	— .49 — .55	32	.75	.30
5-29			1.36	-2.13	1.08	— .55 — .60		2.34	<b> 1.15</b>
0-34	• • •		20	-2.13 $-2.44$	1.15		2.52	2.94	1.50
5-39			.25	-2.44 $-1.27$		23	.59	3.96	<b>→ 1.26</b>
0–44		• •	2.66		.20	38	1.67	.23	41
5-49			2.44	.41	2.05	1.19	11	1.06	1.38
0.54	• •	• • •		1.23	2.74	1.18	1.25	1.54	1.69
E E0	• •	• •	1.86	1.95	2.83	1.19	.96	1.78	1.81
0.64	• •	* • •	1.29	2.76	-1.40	.19	3.67	2.58	1.68
	• •	• •	49	.39	4.76	1.89	20	57	.10
5-69			-1.74	2.97	4.24	28	5.39	4.88	2.22
0-74	• •		5.21	6.53	-19.23	2.76	5.69	5.02	3.76
5 and over	•	• •	4.08	1.55	33.33	7.50	8.24	<b> 7.40</b>	-4.58
ALL AG	ES		.50	.11	.40	.35	1.04	.28	.35



GRAPH No. 32.

The accompanying graph (No. 32) furnishes a representation of the masculinity of the native-born population of Australia, according to age, at the Census of 1911. The base of each small rectangle represents 10 years of age, and the height a masculinity of 5. A separate curve is furnished in respect of each State of birth.

In connexion with the foregoing tables interesting evidence was furnished of the tendency of persons of advanced age to Thus, although settleoverstate their ages. ment in Victoria did not take place until 1836, in South Australia until 1834, or in Western Australia until 1829, there were 25 persons born in Victoria and 9 born in South Australia returned as 80 years of age or upwards, while 2 born in Western Australia were returned as 85 years of age The maximum age possible at or upwards. the date of the Census for a person born in Victoria was 75 years, for one born in South

Australia 77 years and 82 years for one born in Western Australia.

(vi.) Education of the Native-born.—In response to the Census query relative to ability to read and write, 154 persons who were recorded as having been born in Australia were also recorded as being able to read and write in a foreign language, but not in English, whilst 45 others were recorded as being able to read but not write a foreign language, and in addition unable to read or write English. It is possible that these numbers, small as they are, are somewhat in excess of the truth, since cases came under notice in which the query had been understood as relating to ability to read or write a foreign language in addition to English. These figures strikingly indicate the fortunate freedom of Australia from the bi-lingual difficulties experienced in the Dominion of Canada and the Union of South Africa.

The following table furnishes the Education data tabulated, in respect of the Native-born population aged 5 years and upwards.

Education of Native-born Aged 5 Years and Upwards, 3rd April, 1911. FOREIGN LANGUAGE ONLY. ENGLISH. Тотаь, Cannot 5 Years & BIRTHPLACE. Read. Upwards. Read & Write Read only. Read & Write Read only. MALES. 26,017 573,270 545,842 1,382 16 13 New South Wales<sup>1</sup> 12,618 530,922 517,782 169,940  $515 \\ 419$ 6 Victoria 13 5.625 176.015 Queensland 6,632 179,014 172,038 South Australia<sup>2</sup> 306 34 4 3,331 41,134 37,651 80,185 Western Australia 152 i 86,278 1 5.655 436 Tasmania 59,878 1.586,633 75 32 3.210 TOTAL 1,523,438 FEMALES. 20,707 10,630 569,536 532,289 1,560 New South Wales<sup>1</sup> 547,255 1 6 521,091 Victoria 4,962 175,963 Queensland 170,666 328 4 5,405 2,951 178,236 40,436 9 407 51South Australia<sup>2</sup> 172,364 Western Australia . . 3 86,236 4,110 81,769 354 ٠. Tasmania 48,765 1,582,696 13 3,327 79 1,530,512 TOTAL . . PERSONS. 1,142,806  $^{13}_{\ 2}$ 46.724 2,942 New South Wales<sup>1</sup> 1,093,097 12 23,248 1,063,211 1,076 747 713 1,038,873 7ictoria 10,587 12,037 22 16 351,978 340,606 Queensland 357,250 81,570 344,402 85 13 South Australia 2 Western Australia 75.018269 i 9.765 172,514 790 4 161.954 Tasmania 3,169,329 108,643 154 TOTAL 3,053,950 6,537

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

In the succeeding table is given for each State of birth the proportion per cent. of those aged 5 years and upwards who were recorded as unable to read.

Percentage of Native-born Aged 5 Years and Upwards who were Unable to Read, 3rd April, 1911.

Birthplace.	Males.	Females.	Persons.	Birthplace.	Males.	Females.	Persons.
New South Wales <sup>1</sup> Victoria	% 4.54 2.38	3.64 2.00	4.09 2.19	W. Australia Tasmania	% 8.10 6.55	7.30 4.77	7.70 5.66
Queensland South Australia <sup>2</sup>	$\frac{3.20}{3.70}$	2.82 3.03	$\frac{3.01}{3.37}$	TOTAL	3.77	3.08	3.43

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

The relatively large percentage in the case of Western Australia is due in a great measure to the fact that the Western Australian-born are proportionately much more largely represented in the age group 5–9 than is the case with those born in any other State.

(vii.) Conjugal Condition of the Native-born.—The succeeding table furnishes particulars in respect of the Conjugal Condition of the native-born aged 15 years and upwards.

Conjugal Condition of Native-born Aged 15 Years and Upwards, 3rd April, 1911.

BIRTHE	LACE.		!	Married.	Never Married.	Widowed.	Divorced.	Total, 15 & Upwards.
<del></del>	,			]	MALES.	1		
New South Wales <sup>1</sup>				174,283	228,626	9,312	732	412,953
Victoria				170,649	222,287	7,914	455	401,305
Queensland				36,914	77,310	1,057	60	115,341
South Australia 2				65,059	70,796	2,774	96	138,725
Western Australia				6,385	10,779	361	16	17,541
Γasmania				30,882	30,926	2,220	64	64,092
TOTAL				484,172	640,724	23,638	1,423	1,149,957
				F	EMALES.			
New South Wales <sup>1</sup>				203,735	186,196	21,223	834	411,988
Victoria				193,529	193,802	17,743	591	405,665
Queensland				49,751	63,716	2,432	66	115,965
South Australia <sup>2</sup>				72,527	59,612	6,576	77	138,792
Western Australia				8,672	7,897	810	16	17,395
Tasmania				34,105	25,755	5,212	65	65,137
Total			• •	562,319	536,978	53,996	1,649	1,154,942
				P	ERSONS.		]	
New South Wales <sup>1</sup>				378.018	414,822	30,535	1,566	824,941
Victoria		• •		364,178	416,089	25,657	1.046	806,970
Queensland		• •	• • •	86,665	141,026	3,489	126	231,306
South Australia <sup>2</sup>		• •		137.586	130,408	9,350	173	277,517
Western Australia				15,057	18,676	1,171	32	34,936
Tasmania		• • •		64,987	56,681	7,432	129	129,229
TOTAL				1,046,491	1,177,702	77,634	3,072	2,304,899

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

It will be seen that the numbers married, widowed and divorced are very much larger, and the number never married is very much smaller amongst native-born females than amongst native-born males, a result largely due to the fact that females marry on the average at earlier ages than males.

The proportion of the native-born aged 15 years and upwards who were married at the date of the Census is shewn in the following table, the particulars being given separately for each State of birth.

Proportion Married amongst Native-born Aged 15 Years and Upwards, 3rd April, 1911.

_		STATE OF BIRTH.							
PARTICU	LARS.	N.S.W.1	Vic.	Q'land.	S.A. 3	W.A.	Tas.	C'wlth	
Males Females	•••	 % 42.20 49.45	% 42.52 47.71		% 46.90 52.26	% 36.40 49.85	% 48.18 52.36	% 42.10 48.69	
Persons		 45.82	45.13	37.47	49.58	43.10	50.29	45.40	

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

While the proportion of native-born males married is much smaller in all cases than the proportion of native-born females, the disparity is most marked in the cases of Queensland and Western Australia, a result mainly due to the large proportions at the younger ages for these two birthplaces.

(viii.) Religions of the Native-born.—The distribution of the religious denominations amongst the native-born in the several States is by no means uniform, and furnishes in some cases interesting indications of the origins of such populations. For example the extensive German settlements in Queensland and South Australia are reflected in the religious statistics in the large numbers of the native-born of these two States who profess the Lutheran religion. Amongst the Christian Denominations those born in New South Wales were predominant in the cases of the Church of England, the Congregational, the Seventh Day Adventist, the Roman Catholic and the Greek Catholic denominations, whilst those born in Victoria preponderated in the Presbyterian, the Methodist, the Baptist, the Church of Christ and the Salvation Army denominations, and the South Australian-born furnished the largest number of Lutherans.

Particulars in respect of the total native-born population for the various items specified in the religious classification are furnished in the following table:—

Religions of the Native-born (Sexes combined), 3rd April, 1911.

		:	State in w	HICH BORN.			
Religion.	N.S.W. <sup>1</sup>	Vic.	Q'land.	S.A. 2	W.A.	Tas.	C'wlth.
CHRISTIAN—							
Church of England	625,603	427,538	155,234	119,680	50,764	96,047	1,474,866
Presbyterian	141,975	222,386	51.631	24,339	8,604	16,367	465,302
Methodist	126,573	169,306	46,229	107,001	15,511	25,817	490,437
Baptist	15,203	27,495	10,044	22,004	1,638	4,850	81,234
Congregational	17,670	14,895	8,045	13,152	3,167	4,889	61,818
Lutheran	2,438	6,707	16,015	26,044	273	26	51,503
Church of Christ	5,130	15,472	1,999	9,424	1,166	1,288	34,479
Salvation Army	6,245	6,943	3,065	4,125	894	1,491	22,763
Seventh Day Adventist	1,451	1,414	466	686	526	506	5,049
Unitarian	344	319	41	386	9	35	1,134
Protestant (undefined)	25,391	21,939	11,603	12,676	3,136	.7,415	82,160
Roman Catholic	327,559	259,044	105,183	51,952	26,694	31,736	802,168
Greek Catholic	187	94	51	32	37	12	413
Catholic (undefined)	31,164	15,045	6,461	6,393	2,423	4,467	65,953
Others	6,129	6,377	4,635	2,444	524	1,922	22,031
Total, Christian	1,333,062	1,194,974	420,702	400,338	115,366	196,868	3,661,310
NON-CHRISTIAN							
Hebrew	4,548	4,451	500	727	531	204	10,961
Confucian	15	9	41	170	10		245
Mohammedan	72	50	101	59	14		296
$\mathbf{Buddhist}  \dots  \dots$	7.	7	16	6	12	9	57
Pagan	6	6	19	3	33	•:-	67
Others	150	207	103	77	6	13	556
Total, Non-Christian	4,798	4,730	780	1,042	606	226	12,182
INDEFINITE							
Freethinker	540	778	171	263	50	100	1,902
Agnostic	464	800	200	183	25	85	1,757
No Denomination	416	975	151	307	92	148	2,089
Others	899	1,731	307	477	85	157	3,656
Total, Indefinite	2,319	4,284	829	1,230	252	490	9,404
NO RELIGION-							
Ma Dalinian	1 000	0 140	790	1.000	239	230	5,638
No Religion	1,223	2,146	732	1,068	239 4	230	305
Atheist Others	82 38	128 36	$egin{array}{c c} 32 & \\ 1 & \\ \end{array}$	39 15	$\begin{bmatrix} 4 \\ 2 \end{bmatrix}$	4	96
Total, No Religion	1,343	2,310	765	1,122	245	254	6,039
Total	1,341,522	1,206,298	423,076	403,732	116,469	197,838	3,688,935

<sup>&</sup>lt;sup>1</sup> Including Federal Territory. <sup>2</sup> Including Northern Territory.

The percentage of the persons born in each State who were adherents of the various denominations is shewn in the succeeding table. Proportionately to total for birthplace, the Church of England was most strongly represented amongst those born in Tasmania, Presbyterians in the case of Victoria, Methodists, Baptists, Congregationalists, Lutherans, Church of Christ, Salvation Army and Unitarians in the case of South Australia, Seventh Day Adventists in the case of Western Australia and Catholics in the case of New South Wales.

Religion Percentage of Total Native-born Population for each State of Birth, 3rd April, 1911.

		s	TATE IN WE	HICH BORN.			
Religion.	N.S.W.1	Vic.	Q'land.	S.A. 2	W.A.	Tas.	C'wlth.
CHRISTIAN—	%	%	%	%	%	%	%
Church of England	46.63 10.58 9.44 1.13 1.32 .18 .38	35.43 18.44 14.03 2.28 1.23 .56 1.28	36.69 12.20 10.93 2.38 1.90 3.79 .47	29.64 6.03 26.50 5.45 3.26 6.45 2.33 1.02	43.58 7,39 13.32 1.41 2.72 .23 1.00	48.55 8.27 13.05 2.45 2.47 .01 .65	39.98 12.61 13.29 2.20 1.68 1.40 .93
Salvation Army Seventh Day Adventist Unitarian Protestant (undefined) Roman Catholic Greek Catholic Catholic (undefined) Others	.11 .03 1.89 24.42 .01 2.32 .46	.03 1.82 21.47 .01 1.25	.11 .01 2.74 24.86 .01 1.53 1.10	.17 .10 3.14 12.87 .01 1.58 .61	.45 .01 2.69 22.92 .03 2.08 .45	.26 .02 3.75 16.04 .01 2.26 .97	.14 .03 2.23 21.74 .01 1.79
Total, Christian	99.37	99.06	99.44	99.16	99.05	99.51	99.25
NON-CHRISTIAN		-					
Hebrew Confucian Mohammedan Buddhist	34	.37	.12	.18 .04	.46 .01 .01	.10	.30
Pagan	.01		.01	.02	.03	.01	.02
Total, Non-Christian	.36	.39	.18	.26	.52	.11	.33
INDEFINÍTE—	-	,					
Freethinker Agnostic No Denomination Others	.04 .03 .03 .07	.06 .07 .08 .15	.04 .05 .04 .07	.06 .04 .08 .12	.04 .02 .08 .08	.05 .04 .08 .08	.05 .05 .06 .10
Total, Indefinite	.17	.36	.20	.30	.22	.25	.26
NO RELIGION-				سبب کاشنده و دسته آبدادی و پیسد بن			
No Religion	.09	.18 .01	.17 .01	.27 .01	.20	.12	.15 .01
Total, No Religion	.10	.19	.18	.28	.21	.13	.16
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

<sup>&</sup>lt;sup>1</sup> Including Federal Territory. <sup>2</sup> Including Northern Territory.

Particulars concerning the relative numbers of male and female adherents of each religion for each State of birth are given in the following table:—  $\,$ 

Masculinity of Native-born Religious Adherents (Excess of males over females per 100 of sexes combined), 3rd April, 1911.

	-		STATE IN	WHICH BORN	r <b>.</b>		
Religion.	N.S.W. <sup>1</sup>	Vic.	Q'land.	S.A. <sup>2</sup>	W.A.	Tas.	C'wlth.
CHRISTIAN—		<u>'</u>	<u>'</u>	3			
Church of England	1.20	1.02	.81	.95	1.46	.60	1.11
Presbyterian	.66	1.18	.44	2.62	2.95	.60	1.18
Methodist	- 1.94	2.77	- 1.24	56	.91	1.99	- 1.77
Baptist	- 7.57	8.17	- 3.54	4.69	.61	8.54	_ 6.47
Congregational	<b>4.92</b>	— 7.54	3.07	- 5.22	2.18	4.93	— 5.32 — 5.32
Lutheran	.57	1.39	.49	3.47	8.42	23.08	2.15
Church of Christ	11.46	10.63	12.16	10.63	-1.03	8.39	-10.59
0 1	- 8.15	-10.03 -11.62	- 8.65	-8.75	-2.46	- 2.48	-10.38 $-9.02$
Salvation Army Seventh Day Adventist	-6.13	11.02 19.09	-8.03 -10.73	-20.41	3.04	$\frac{-2.48}{-10.28}$	-9.02 $-15.79$
Unitarian	7.56	3.45	31.71	9.84	77.78	31.43	7.67
Protestant (undefined)	6.87	10.21	6.83	6.26	26	11.07	7.96
Roman Catholic	.56	.00	.22	1.01	.37	45	.35
Greek Catholic	15.51	4.26	13.73	.00	18.92	16.67	10.90
Catholic (undefined)	- 1.61	4.99	2.77	4.61	3.26	5.71	1.36
Others	7.10	- 8.61	.24	2.78	3.44	- 1.87	- 4.88
Total, Christian	.40	— .1 <b>0</b>	.25	.11	.95	.12	.23
NON-CHRISTIAN-							
Hebrew	.71	1.24	7.20	<b></b> 7.84	<b>—</b> 2.45	2.94	1.41
Confucian	46.67	55.56	12.20	18.82	.00		20.00
Mohammedan	_ 2.78	32.00	32.67	18.64	14.29		-20.61
Buddhist	14.29	100.00	37.50	100.00	33.33	55.56	40.35
Pagan	100.00	100.00	26.32	33.33	45.45		50.75
Others	→ 1.33	- 1.45	12.62	<b> 22.08</b>	→ 66.67	- 38.46	7.37
Total, Non-Christian	46	1.18	.77	- 4.41	66	- 2.65	_ 1.24
NDEFINITE-				1			
Freethinker	60.37	65.55	60.23	61.98	44.00	64.00	65.09
Agnostic	64.22	50.75	37.00	57.38	60.00	57.65	56.23
No Denomination	5.29	12.82	16.56	15.96	- 8.70	17.57	11.95
Others	11.68	11.27	32.90	22.43	17.65	17.20	15.40
TOTAL, INDEFINITE	32.38	28.85	36.55	34.47	17.46	33.88	32.3
NO RELIGION		-				-	-
No Religion	50.78	58.34	42.62	52.81	28.87	63.48	54.6
Atheist	75.61	67.19	43.75	69.23	100.00	80.00	74.4
Others	42.11	94.44	100.00	100.00	100.00	100.00	82.29
Total, No Religion	52.05	59.39	42.75	54.01	30.61	65.35	56.0
Total	.50	.11	.40	.35	1.04	.28	.4

<sup>&</sup>lt;sup>1</sup> Including Federal Territory.

14. Oversea Population.—For the sake of convenience of reference the term "Oversea Population" is here used to denote that portion of the population of Australia born outside the Commonwealth. Particulars in respect of such population are as follows:—

Oversea Population of Australia, 1881 to 1911.

Date of Census.				PERS	ons.	Masculinity (Excess of
f Cens	us.	Males.	Females.	Number.	Percentage on total population.	males over females per 100 of sexes combined).
		 500,733 613,518 517,326 462,083	326,736 394,671 341,991 303,987	827,469 1,008,189 859,317 766,070	36.77 31.76 22.77 17.20	21.03 21.71 20.40 20.64
		 	500,733 613,518	500,733 326,736 613,518 394,671	Males. Females. Number.	Number. Percentage on total population.

<sup>&</sup>lt;sup>2</sup> Including Northern Territory.

The increases or decreases in the number of the oversea population of the Commonwealth during the three decennial periods under review are as follows:—

#### Variations Oversea Population, 1881 to 1911.

	Period.		MAL	ES.	Fем	ALES.	Persons.		
Peri	OD.		Numerical.	Centesimal.	Numerical.	Centesimal.	Numerical.	Centesimal.	
1881-1891 1891-1901 1901-1911			$\begin{array}{c c} + 112,785 \\ - 96,192 \\ - 55,243 \end{array}$	$\begin{array}{ c c c c c }\hline & & & & & \\ & + & 22.52 & & \\ & - & 15.68 & & \\ & - & 10.68 & & \\ \hline \end{array}$	+ 67,935 52,680 38,004	$\begin{array}{c c} & \% \\ + 20.79 \\ - 13.35 \\ - 11.11 \end{array}$	$\begin{array}{c c} + 180,720 \\ - 148,872 \\ - 93,247 \end{array}$	+21.84 $-14.77$ $-10.85$	

Note.—In this table increases are denoted by +, decreases by -.

15. New Zealand-born Population.—(i.) Distribution.—As already mentioned, the population of New Zealand birth enumerated at the Australian Census of 3rd April, 1911, totalled 32,117, comprising 16,998 males, and 15,119 females. These were distributed throughout the various States and Territories as follows:—

New Zealand-born Population of Australia, 3rd April, 1911.

	MAL	ES.	FEMA	LES.	PERS	ons.	Masculin-
STATES AND TERRITORIES.	Number.	Per 1000 of male population.	Number.	Per 1000 of female population.	Number.	Per 1000 of total population.	(Excess of males over females per 100 of sexes combined
STATES							ļ
New South Wales	7,354	8.57	6,711	8.51	14,065	8.54	4.57
Victoria	5,013	7.65	5,147	7.80	10,160	7.72	-1.32
Queensland	1,641	4.98	947	3.43	2,588	4.27	26.82
South Australia	557	2.69	435	2.16	992	2.43	12.30
Western Australia	1,835	11.36	1,244	10.32	3,079	10.91	19.19
Tasmania TERRITORIES—	579	5.93	632	6.75	1,211	6.33	4.38
Northern	17	6.22	1	1.74	18	5.44	88.89
Federal	2	2.02	2	2.77	4	2.33	.00
Total	16,998	7.35	15,119	7.06	32,117	7.21	5.85

Leaving the Territories out of account, New South Wales contained the largest number of persons of New Zealand birth, while South Australia contained the smallest number. Proportionately to population New Zealanders were most largely represented in Western Australia, and least largely in South Australia.

- (ii.) Metropolitan Residents.—As compared with the native-born, the New Zealand residents of the Commonwealth shewed a very marked tendency to aggregate in the Metropolitan areas. Thus, whilst 36.75 per cent. of the native-born population of Australia were resident in the Metropolitan towns, no less than 59.77 per cent. of the New Zealand born population were so resident, these centres accounting for 19,196 out of a total of 32,117.
- (iii.) Ages.—Tabulated in quinquennial age groups the data in respect of New Zealand-born population are as follows:—

New Zealand-born Population of Australia in Age Groups, 3rd April, 1911.

Age last birthday.	Males.	Females.	Persons.	Masculin- ity(Excess of males over females per 100 of sexes combined)	Age last birthday.	Males.	Females.	Persons.	Masculinity(Excess of males over females per 100 of sexes combined)
0-4 5-9 10-14 15-19 20-24 25-29 30-34 35-39	834 835 561 695 1,870 2,775 2,825 2,041	809 859 555 692 1,616 2,669 2,669 1,924	1,643 1,694 1,116 1,387 3,486 5,444 5,494 3,965	1.52 1.42 .54 .22 7.29 1.95 2.84 2.95	40-44 45-49 50-54 55-59 60-64 65-69 70 & over	2,041 1,361 539 282 164 126 49	1,542 953 350 209 148 101 23	3,583 2,314 889 491 312 227 72 32,117	13.93 17.63 21.26 14.87 5.13 11.01 36.11

Of the total of 32,117 there were 24,286, or rather less than 76 per cent., between the ages of 20 and 50.

(iv.) Education.—The particulars ascertained concerning the elementary education of the New Zealand-born population are as follows:—

Education of New Zealand-born Aged 5 Years and Upwards, 3rd April, 1911.

Particulars.		Engli	ISH.	Foreign Lan	GUAGE ONLY.	Cannot	Total, 5 Years	
Part	FICULA	RS.	Read & Write	Read only.	Read & Write	Read only.	Read.	and upwards.
Males Females	•••	• •	15,897 14,051	. 17 27	5 1		245 231	16,164 14,310
Persons		• •	29,948	44	6		476	30,474

Of the New Zealand-born males aged 5 years and upwards, 1.52 per cent. were unable to read, while in the case of the females the corresponding proportion was 1.61 per cent. Five males and one female were recorded as able to read and write a foreign language, but not English. In this connexion see par. 13. (vi.) above. (p. 138).

(v.) Conjugal Condition.—The number and percentage of the New Zealand-born population aged 15 and upwards of each sex in each conjugal condition were as follows:—

Conjugal Condition of New Zealand-born Aged 15 and Upwards, 3rd April, 1911.

Part	ic <b>ular</b> s.		Married.	Never Married.	Widowed.	Divorced.	Total, 15 and upwards.
				MALES		·	
Number Percentage	• •	••	7,686 52.05	6,671 45.17	$\begin{array}{c} 358 \\ 2.42 \end{array}$	53 .36	14,768 100.00
				FEMALE	8.		
Number Percentage	••		7,899 $61.26$	4,307 33.40	$639 \\ 4.95$	.39	12,896 100.00
				PERSON	3.		
Number Percentage	••		$15,585 \\ 56.34$	10,978 39.68	997 3.60	$\begin{matrix} 104 \\ .38 \end{matrix}$	27,664 100.00

(vi.) Religion.—In the following table are given particulars relative to the number, percentage and masculinity of New Zealand-born persons classed under the various religious categories used at the Census.

New Zealand-born Population according to Religion (Sexes combined), 3rd April, 1911.

Religion.	Persons.	Per- centage.	Masculinity (Excess of males over females per 100 of sexes combined).	Religion.	Persons	Per- centage.	Masculinity (Excess of males over females per 100 of sexes combined).
CHRISTIAN—	1	17.00		NON-CHRISTIAN Hebrew	412	1.28	6.80
Church of England	14,644	45.60	5.57	Confucian	3	.01	- 33.33
Presbyterian Methodist	5,603 2,461	17.45 7.66	12.48 .12	Mohammedan Buddhist	2	١,	100.00
D	666	2.07	9.61	D	1	.01	100.00
Congregational	452	1.41	9.01 11.50	Others	15	.05	20.00
Lutheran	41	.13	26.83	Others	10		
Church of Christ	316	.98	17.72	Total, Non-Christ'n	433	1.35	<b>—</b> 5.31
Salvation Army	405	1.26	13.09				
Seventh Day Ad-				INDEFINITE—	]		
ventist	98	.31	12.24	Freethinker	74	.23	67.57
Unitarian	37	.12	18.92	Agnostic	67	.21	61.19
Protestant (unde-		*		No Denomination	40	.12	25.00
fined)	948	2.95	16.67	Others	111	.35	11.71
Roman Catholic	4,703	14.64	4.91				
Greek Catholic	2	.01	. 00	Total, Indefinite	292	.91	39.04
Catholic (undefined)	464	1.44	86				
Others	348	1.08	4.60	NO RELIGION—			
				No Religion	171	.53	68.42
				Atheist	20	.06	90.00
	1			Others	13	.04	53.85
Total, Christian	31,188	97.11	5.28				
				Total, No Religion	204	.63	69.61
				Total	32,117	100.00	5.85

16. European-born Population.—(i.) Distribution.—Of the total population of 4,455,005 recorded at the Census of 3rd April, 1911, 673,006, or 15 per cent. were of European-birth, while of these latter 598,182, or nearly 89 per cent. hailed from the United Kingdom. The only other European country largely represented was Germany, with a total of 33,381.

The numbers and proportions of total population for the various birth places are as follows:—

European-born Population of Australia according to Countries of Birth, 3rd April, 1911.

,		М	ALES.	Fema	ALES.	Pers	ons.	Mase'linity (Excess of males over
BIRTHPLACE.		Number.	Per 1000 of male population	Number.	Per 1000 of female population	Number.	Per 1000 of total population	females per 100 of sexes combined)
EUROPE—								
England		206,934	89.46	143,316	66.91	350,250	78.62	18.16
Wales		7,461	3.23	4,857	2.27	12,318	2.76	21.14
Scotland		55,635	24.05	38,614	18.03	94,249	21.16	18.06
Ireland		70,967	30.68	70,398	32.87	141,365	31.73	.40
Isle of Man		689	.30	330	.15	1,019	.23	35.23
Other European I	Brit-		1		}	,		
ish Possessions		1,466	.63	940	.44	2,406	.54	21.86
Austria-Hungary		2,425	1.05	382	.18	2,807	.63	72.78
Belgium		244	.11	99	.05	343	.08	42.27
Denmark		4,316	1.87	1,414	.66	5,730	1.29	50.65
France		1,996	.86	914	43	2,910	.65	.37.18
Germany		21,973	9.50	11,408	5.32	33,381	7.49	31.65
Greece	!	1,713	.74	106	.05	1,819	.41	88.35
$\mathbf{Italy}$		5,608	2.43	1,190	.55	6,798	1.53	64.99
Netherlands		651	.28	103	.05	754	.17	72.68
Norway		3,074	1.33	418	.19	3,492	.78	76.06
Portugal		160	.07	15	.01	175	.04	82.86
Russia		3,453	1.49	1,055	.49	4,508	1.01	53.19
Spain		495	.21	171	.08	666	.15	48.65
${\bf Sweden} \qquad \dots$		5,144	2.22	508	.24	5,652	1.27	82.02
Switzerland $\dots$		1,314	.57	442	.21	1,756	.39	49.66
Other Europ. Cour	itries	468	.20	140	.06	608	.14	53.95
Total, Europe		396,186	171.28	276,820	129.24	673,006	151.07	17.74

Those born in the United Kingdom represented 134.27 per thousand, or approximately  $13\frac{1}{2}$  per cent. of the total population, while the German-born represented 7.49 per 1000. Of the other birthplaces the three Scandinavian countries, Denmark, Sweden and Norway together were represented by 3.34 per 1000, Italy with 1.53 per 1000, and Russia with 1.01 per 1000 being the only other countries to exceed 1 per 1000.

In all cases the number of males exceeded the number of females, the excess being most marked in the cases of Greece, Portugal and Sweden, and least marked in the case of the United Kingdom, especially in that of Ireland, the males in this instance exceeding the females by only 569 in a total of 141,365.

The distribution of the European-born population over the several States and Territories is given in the following table, those born in the various divisions of the United Kingdom being separately shewn.

European-born Population according to States and Territories in which Resident, 3rd April, 1911.

States and Territories.	England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Total, Europe
		MALES				
STATES						
New South Wales	75,637	2,821	19,646	24,497	15,676	138,277
Victoria	48,726	1,516	14,396	19,433	11,659	95,730
Queensland	38,988	1,507	12,274	16,356	13,133	82,258
South Australia	16,938	543	3,334	3,736	5,698	30,249
Western Australia	21,141	902	4,764	5,808	8,186	40,801
Tasmania	5,308	158	1,162	1,062	787	8,477
TERRITORIES—						,
Northern	123	13	43	48	46	273
Federal	73	1	16	27	4	121
Total	206,934	7,461	55,635	70,967	55,189	396,186

European-born Population according to States and Territories in which Resident-continued.

States and Territories.		England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Total, Europe
		-'	FEMAL	ES.			
STATES—							
New South Wales		47,874	1,608	12,003	22,925	4.322	88,732
Victoria		39,220	1,213	12,567	22,649	3.904	79.553
Queensland		26,932	1,139	8,462	15,557	7,297	59,387
South Australia		13,293	352	2,380	4,351	2,379	22,755
Western Australia		12,137	440	2,249	3,765	1,365	19,956
Tasmania		3,814	103	941	1,125	363	6,346
TERRITORIES—	• •	0,011	100	011	1,120	000	0,510
Northern		24	2	4	8	4	42
Federal		22		8	18	i	49
							- I
TOTAL	• •	143,316	4,857	38,614	70,398	19,635	276,820
			PERSO	NS.			
STATES—							
New South Wales		123,511	4,429	31.649	47,422	19.998	227,009
Victoria		87,946	2,729	26,963	42,082	15,563	175,283
Queensland		65.920	2,646	20,736	31,913	20,430	141,645
South Australia		30,231	895	5,714	8,087	8,077	53,004
Western Australia		33,278	1,342	7,013	9,573	9,551	60,757
Tasmania		9,122	261	2.103	2,187	1,150	14,823
TERRITORIES—				_,_,			,
Northern		147	15	47	56	50	315
Federal		95	1	24	45	5	170
TOTAL		350,250	12,318	94,249	141,365	74,824	673,006

In the case of each birthplace the State having the larger total population had the greater number for that birthplace except (i.) in the case of Western Australia, where there were more persons for each birthplace specified than there were in South Australia, and (ii.) in the case of those born in the "Rest of Europe," where the Queensland total exceeded that for any other State.

- (ii.) Metropolitan Residents.—Amongst the European-born population the tendency to aggregate in Metropolitan areas is most marked in the case of those born in England, and least in evidence in those born outside the United Kingdom. Thus, whilst 48 per cent. of the English-born population of the Commonwealth were resident in Metropolitan areas, 44 per cent. of the Scotch-born, and  $41\frac{1}{2}$  per cent. of the Irish-born were so resident, as compared with only 36 per cent. in the case of those born in Wales, and  $34\frac{1}{2}$  per cent. in the case of those born outside of the United Kingdom. As already noted, the proportion of the native-born so resident is about  $36\frac{3}{4}$  per cent.
- (iii.) Length of Residence.—Taken as a whole, about 73 per cent. of the European-born population of the Commonwealth had, at the date of the Census, been resident in Australia for upwards of 20 years. The percentage having such a length of residence varies with the birthplace, and is greatest in the case of those born in Ireland and least amongst those born outside the United Kingdom. The respective percentages are approximately as follows:—Ireland, 85 per cent.; Wales, 76 per cent.; Scotland, 72 per cent.; England, 71 per cent.; and the Rest of Europe, 62 per cent. Details in respect of these birthplaces are as follows:—

Length of Residence of European-born Population, 3rd April, 1911.

<del>-</del> _	_		- ,			
Particulars.	England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Total, Europe.
		MALES.				
Number resident under 20 years Number resident 20 years and over	64,390 142,544	2,022 5,439	17,019 38,616	12,124 58,843	23,040 32,149	118,595 277,591
TOTAL	206,934	7,461	55,635	70,967	55,189	396,186
Proportion per cent. over 20 years	68.88	72.90	69.41	82.92	58.25	70.07
		FEMALE	S.	5		
Number resident under 20 years Number resident 20 years and over	36,202 107,114	964 3,893	9,223 29,391	9,258 61,140	5,370 14,265	61,017 215,803
TOTAL	143,316	4,857	38,614	70,398	19,635	276,820
Proportion per cent. over 20 years	74.74	80.15	76.11	86.85	72.65	77.96

Length of Residence of European-born Population.—continued.

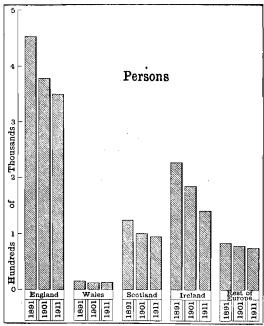
Particulars.	England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Total, Europe.
		PERSONS	3.	· <u> </u>		
Number resident under 20 years Number resident 20 years and over	100,592 249,658	2,986 9,332	26,242 68,007	21,382 119,983	28,410 46,414	179,612 493,394
TOTAL	350,250	12,318	94,249	141,365	74,824	673,006
Proportion per cent. over 20 years	71.28	75.76	72.16	84.87	62.03	73.31

(iv.) Comparative Results for three Censuses.—The following tables furnish a comparison for the Censuses of 1891, 1901 and 1911 of the number and proportion of the European-born population of Australia.

European-born Population, 1891, 1901 and 1911.

,	_	<del>-</del>	- Poun-	orn Pop		JUL, 1001	and loll	·			
•			MALES.			FEMALES	<b>.</b>	Persons.			
BIRTHPLACE.		1891.	1901.	1911.	1891.	1901.	1911.	1891.	1901.	1911.	
					" NUMBEF	₹.		и			
England		272,266	221,664	206,934	181,130	157,223	143,316	453,396	378,887	350,250	
Wales			7,178	7,461	5,629	4,836	4,857	14,694	12,014	12,318	
Scotland		73,267	58,892	55,635	50,970	43,078	38,614	124,237	101,970	94,249	
Ireland	• •		92,254	70,967	111,376	92,216	70,398	227,698	184,470	141,365	
Rest of Europe	• •	61,498	57,115	55,189	23,150	20,983	19,635	84,648	78,098	74,824	
TOTAL, EUROPE		532,418	437,103	396,186	372,255	318,336	276,820	904,673	755,439	673,006	
			PER 1	000 OF T	OTAL F	OR AUS	ΓRALIA.	TE	1		
England		159.78	112.07	89.46	123.19	87.55	66.91	142.83	100.40	78.62	
Wales		5.32	3.63	3.23	3.83	2.69	2.27	4.63	3.18	2.76	
Scotland		42.99	29.77	24.05	34.66	23.99	18.03	39.14	27.02	21.16	
Ireland		68.26	46.64	30.68	75.75	51.35	32.87	71.73	48.88	31.73	
Rest of Europe	٠.	36.09	28.88	23.86	15.74	11.68	9.16	26.66	20.70	16.80	
TOTAL, EUROPE	٠.	312.44	220.99	171.28	253.17	177.26	129.24	284.99	200.18	151.07	

### European-born Population of Australia.



GRAPH No. 33.

It will be seen from the foregoing table that the only case in which there was a larger number in 1911 than in 1901 was in that of the birthplace Wales, the number of males having in this instance increased by 283, and of females by 21. In all cases the number in 1901 was less than in 1891. The proportion per 1000 of the total population of Australia was less in all cases in 1901 than in 1891, and less in 1911 than in 1901.

The accompanying graph (No. 33) furnishes a representation of the number of persons of European birthplaces who were resident in Australia at the Censuses of 1891, 1901, and 1911. The particulars are shewn separately for those born in (i.) England, (ii.) Wales, (iii.) Scotland, (iv.) Ireland, and (v.) Rest of Europe, and indicate in all cases, except that of Wales, a more or less rapid decline in the numbers at successive Censuses.

The masculinity of the population for each birthplace at each Census is given in the following table, which shews in each case the excess of males over females per 100 of the sexes combined.

Masculinity of European-born Population, 1891, 1901 and 1911.

	 Censu	IS.	 	England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Total, Europe.
1891	 		 	20.10	23.38	17.95	2.17	45.30	17.70
1901	 		 	17.01	19.49	15.51	.02	46.26	15.72
1911	 • •		 	18.16	21.14	18.06	.40	47.52	17.74
				1					<u> </u>

(v.) Ages.—The succeeding table furnishes details in respect of the ages of the European-born males:—

European-born Males, according to Age, 3rd April, 1911.

		•					Total,			
Ac	E LAST	вінтн	DAY.		England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Europe.
0–4					1,669	45	443	76	164	2,397
5-9					2,449	55	665	143	323	3,635
10-14					2,230	56	613	157	428	3,484
15-19					3,853	105	805	362	1,688	6,813
20-24					11,356	357	2,779	1,529	4,086	20,107
25-29					16,328	536	4,308	2,771	5,011	28,954
30-34					16,514	612	4,404	3,472	4,687	29,689
<b>35</b> –39					16,078	646	3,890	4,296	4,381	29,291
40-44					18,179	648	4,397	6,214	4,854	34,292
<b>45–4</b> 9					21,840	878	6,039	8,875	5,606	43,238
50-54					20,864	922	6,165	8,859	5,816	42,626
55-59					19.882	792	5,368	6,830	5,052	37,924
60-64	• • •				17,336	579	4.576	6,342	4,104	32,937
65–69					13,706	445	3,711	7,198	3,421	28,481
70-74					10,960	394	3,247	6,998	2,728	24,327
7579					7,953	224	2,438	4,443	1,760	16,818
80-84					4,128	127	1,290	1,734	774	8,053
85-89				, .	1,256	30	395	494	244	2,419
90-94					302	9	83	136	52	582
9599					42	1	14	28	8	93
100 and o	ver	• •	• •	• •	9	••	5	10	2	26
Тотал	i				206,934	7,461	55,635	70,967	55,189	396,186

Similar particulars in respect of the European-born females are contained in the following table :—  $\,$ 

European-born Females, according to Age, 3rd April, 1911.

						Coun	TRY OF BIRT	н.		Total,
AGE	LAST	BIRTH	DAY.		England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Europe.
0-4					1,578	44	425	79	158	2,284
5-9					2,251	52	604	150	258	3,315
10–14					2,219	60	573	169	330	3,351
15–19					2,122	61	569	353	372	3,477
20-24					4,611	117	1,272	1,056	695	7,751
2529					9,634	340	2,365	2,274	1,201	15,814
30-34					11,789	368	2,904	3,013	1,525	19,599
35-39					11,736	456	2,681	4,545	1,639	21,057
10 <del>-14</del>					11,541	366	2,728	6,212	1,683	22,530
<b>45–49</b>					12,726	523	3,264	7,905	1,783	26,201
50-54					12,638	542	3,456	7,080	1,829	25,545
5559					14,066	550	3,817	5,888	1,904	26,225
60–64					13,855	409	3,634	7,308	2,002	27,208
6 <b>5</b> –69					11,316	348	3,349	8,532	1,653	25,198
70–74					9,312	289	2,926	8,082	1,194	21,803
75–79			• •		6,603	202	2,275	5,011	840	14,931
80-84			• •		3,587	90	1,225	1,909	364	7,175
8589					1,323	35	415	610	161	2,544
90-94					354	5	102	171	38	670
95–99					48		25	37	6	116
100 and ov	er	•••	• •	• •	7	••	5	14	••	26
						****				
TOTAL					143,316	4.857	38,614	70,398	19,635	276,820

The next table contains particulars relative to age for the sexes combined:—

Total European-born Population, according to Age, 3rd April, 1911.

						Cou	NTRY OF BI	ктн.		Total,
,	AGE LAS	T BIRT	HDAY.		England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Europe.
0-4					3,247	89	868	155	322	4,681
5–9					4,700	107	1,269	293	581	6,950
l014					4,449	116	1,186	326	758	6,835
5-19					5,975	166	1,374	715	2,060	10,290
2024					15,967	474	4,051	2,585	4,781	27,858
25-29					25,962	876	6,673	5,045	6,212	44,768
3034				٠.	28,303	980	7,308	6,485	6,212	49,288
5-39					27,814	1,102	6,571	8,841	6,020	50,348
0-44					29,720	1,014	7,125	12,426	6,537	56,822
5-49					34,566	1,401	9,303	16,780	7,389	69,439
5054					33,502	1,464	9,621	15,939	7,645	68,171
55-59					33,948	1,342	9,185	12,718	6,956	64,149
3064					31,191	988	8,210	13,650	6,106	60,145
35-69					25,022	793	7,060	15,730	5,074	53,679
70-74					20,272	683	6,173	15,080	3,922	46,130
15-79	••				14,556	426	4,713	9,454	2,600	31,749
30-84	•	• •			7,715	217	2,515	3,643	1,138	15,228
5-89					2,579	65	810	1,104	405	4,963
0-94					656	14	185	307	90	1,252
5-99					90	1	39	65	14	209
.00 and	d over	.7.	••	••	16	••	10	24	2	52
ŗ	<b>Fota</b> l	• •	••		350,250	12,318	94,249	141,365	74,824	673,006

Of the total of 673,006 there were 213,407, or nearly 32 per cent. above the age of 60, while only 18,466 or about  $2\frac{3}{4}$  per cent. were under the age of 15.

The proportion of the European-born in each age group is shewn in the attached table :---

Proportion per cent. of European-born Population in Successive Age-groups. (Sexes combined.) 3rd April, 1911.

						Coun	TRY OF BIRT	н.		Total,
Ag	E LAST	BIRTH	DAY.		England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Europe
·					%	%	%	%	%	%
0-4	• •	• •			.93	.72	.92	.11	.43	.69
5-9	• •	• •			1.34	.87	1.35	21	.78	1.03
0-14	• •		• •		1.27	.94	1.26	.23	1.01	1.02
5-19	• •		• •		1.71	1.35	1.46	.50	2.75	1.53
0-24					4.56	3.85	4.30	1.83	6.39	4.14
<b>5–2</b> 9					7.41	7.11	7.08	3.57	8.30	6.65
0-34					8.08	7.96	7.75	4.59	8.30	7.32
5-39					7.94	8.95	6.97	6.25	8.05	7.48
0-44					8.48	8.23	7.56	8.79	8.74	8.44
5-49					9.87	11.37	9.87	11.87	9.88	10.32
0-54					9.56	11.89	10.21	11.27	10.22	10.13
5-59					9.69	10.89	9.74	9.00	9.30	9.53
064					8.90	8.02	8.71	9.65	8.16	8.94
5-69					7.14	6.44	7.49	11.13	6.78	7.98
0-74					5.79	5.54	6.55	10.67	5.24	6.85
5–79					4.16	3.46	5.00	6.69	3.47	4.72
0-84					2.20	1.76	2.67	2.58	1.52	2.26
5-89					.74	.53	.86	.78	.54	.74
0-94				٠	.19	.11	.20	.22	.12	.19
5-99					.03	.01	.04	.04	.02	.03
o and o	ver	• •	••	• •	.01	••	.01	.02	••	.01
TOTAL	••				100.00	100.00	100.00	100.00	100.00	100.00

The age group most largely represented was 45-49 in the cases of England and Ireland, and 50-54 in those of Wales, Scotland and the Rest of Europe.

The following table furnishes particulars concerning the masculinity of the European-born population in age groups.

Masculinity of European-born Population. (Excess of males over females per 100 of sexes combined).

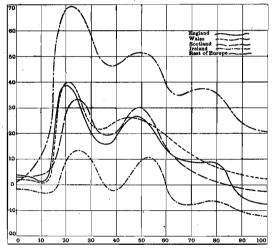
3rd April, 1911.

						Coun	TRY OF BIRT	r <b>H.</b>		Total,
Age	LAST	BIRTH.	DAY.		England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Europe
04					2.80	1.12	2.07	1.94	1.86	2.41
5–9					4.21	2.80	4.81	2.39	11.19	4.60
1014		• •			.25	3.45	3.37	3.68	12.93	1.95
1519	٠.				28.97	26.51	17.18	1.26	63.88	32.42
20-24					42.24	50.63	37.20	18.30	70.93	44.35
25–29					25.78	22.37	29.12	9.85	61.33	29.35
3034		• •			16.69	24.90	20.53	7.08	50.90	20.47
35–39					15.61	17.24	18.40	2.82	45.51	16.35
<b>1</b> 044					22.34	27.81	23.42	.02	48.51	20.70
<b>15–4</b> 9					26.37	25.34	29.83	5.78	51.74	24.54
<b>5054</b>					24.55	25.96	28.16	11.16	52.15	25.06
5 <b>5</b> –59					17.13	18.03	16.89	7.41	45.26	18.24
6064			٠,		11.16	17.21	11.47	7.08	34.43	26.15
65–69					9.55	12.23	5.13	8.48	34.84	6.12
70–74					8.13	15.37	5.20	<b></b> 7.19	39.11	5.47
75–79	٠.				9.27	5.16	3.46	6.01	35.38	5.94
8084	٠.				7.01	17.05	2.58	4.80	36.03	5.77
35-89					2.60	7.69	2.47	10.50	20.49	-2.52
90 and over		• •		• •	7.35	33.33	12.82	12.12	16.98	-7.34
All ages			•		18.16	21.14	18.06	.40	47.52	17.74

NOTE: - signifies excess of females.

In all cases the excess of males was most marked in the age group 20-24, and least in evidence at the young and old ages. In the case of Ireland there was an excess of females at ages under 15 and above 60.

#### Masculinity of European-born Population of Australia.



GRAPH No. 34.

The accompanying graph (No. 34) furnishes a representation of the masculinity of the European-born population of Australia, at the Census of 3rd April, 1911. The case of each small square represents 10 years of age, and the height a masculinity of 10. An interesting feature of these curves is their wave like form and the approximate synchronising of maximum and minimum points.

(vi.) Education.—In the following table are given particulars in respect of the ability of the European-born population to read and write.

Education of European-born Population Aged 5 Years and upwards, 3rd April, 1911.

	Engl	ish.	Foreign Lan	GUAGE ONLY.	Cannot	Total, 5 Years
BIRTHPLACE.	Read & Write	Read only.	Read & Write	Read only.	Read.	and upwards.
		M	ALES.			
England	. 7,121 . 54,381 . 66,010 . 42,088	1,126 63 201 936 613	11 5  3 9,592 9,611	8  1 6 659	5,191 227 609 3,936 2,073	205,265 7,416 55,192 70,891 55,025
		FE	EMALES.	l l		
England Wales Scotland Ireland Rest of Europe	4,415 36,781 61,506	1,945 126 577 2,506 418	5 1  6 3,691	2 3 6 	3,878 268 825 6,301 1,121	141,738 4,813 38,189 70,319 19,477
TOTAL, EUROPE	252,413	5,572	3,703	455	12,393	274,536

Education of European-born Aged 5 Years and Upwards-continued.

Birthplace.			Engi	ISH.	Foreign Lan	GUAGE ONLY.	Cannot	Total,
			Read & Write	Read only.	Read & Write	Read only.	Read.	5 Years & Upwards.
			, , , , ,	PER	SONS.			
England		٠	334,837	3,071	16	. 10	9,069	347,003
Wales	٠.		11,536	189	6	3	495	12,229
Scotland	٠.		91,162	778		7	1,434	93,381
[reland			127,516	3,442	9	6	10,237	141,210
Rest of Euro	рe	• •	55,891	1,031	13,283	1,103	3,194	74,502
TOTAL, ]	TOTAL, EUROPE		620,942	8,511	13,314	1,129	24,429	668,325

It will be seen that 57 born in the United Kingdom are recorded as able to read or read and write a foreign language, but not English. In this connexion see par. 13 (vi.) of the present chapter. (p. 138).

The proportion of those aged 5 years and upwards unable to read is given below for each of the birthplaces specified:—

Percentage of European-born Population, Aged 5 Years and Upwards, who were Unable to Read, 3rd April, 1911.

Particulars.										
					England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Total, Europe.
Males Females Persons	• • • • • • • • • • • • • • • • • • • •	• •		•	2.53 2.74 2.61	3.06 5.57 4.05	1.10 2.16 1.54	5.55 8.96 7.25	% 3.77 5.76 4.29	3.06 4.51 3.66

The largest proportion of illiteracy was in evidence amongst the natives of Ireland, the lowest amongst those of Scotland, but in no case was the proportion a high one.

(vii.) Conjugal Condition.—The following table furnishes a classification of the European born population, aged 15 years and upwards, according to sex and conjugal condition.

Conjugal Condition of European-born Population, Aged 15 Years and upwards 3rd April, 1911.

	BIRTE	IPLACE			Married.	Never Married.	Widowed.	Divorced.	Total, 15 and upwards
					MA	LES.	<u></u>	·	
England					125,008	55,764	19,370	444	200,586
Wales					4,454	2,135	697	19	7,305
Scotland					31,592	16,886	5,350	86	53,914
Ireland					37,822	24,141	8,537	91	70,591
Rest of Eu	rope	• •			28,870	21,235	4,022	147	54,274
Total,	EUROP	E			227,746	120,161	37,976	787	386,670
					FEM	ALES.			
England				\	84,417	19,047	33,557	247	137,268
Wales			, .		3,041	523	1,127	10	4,701
Scotland					21,146	5,822	9,996	48	37,012
Ireland					36,133	10,959	22,837	71	70,000
Rest of Eu	$\mathbf{rope}$	• •	• •		12,576	1,995	4,280	38	18,889
Total,	EUROE	PE			157,313	38,346	71,797	414	267,870
					PERS	sons.	v		
England					209,425	74,811	52,927	691	337,854
Wales					7,495	2,658	1,824	29	12,006
Scotland				!	52,738	22,708	15,346	134	90,926
Ireland					73,955	35,100	31,374	162	140,591
Rest of Eu	rope	• •			41,446	23,230	8,302	185	73,163
Total, I	EUROPE				385,059	158,507	109,773	1,201	654,540

In the succeeding table is shewn for each of the birthplaces specified the proportion of married persons amongst those aged 15 years and upwards.

Proportion Married amongst those Aged 15 Years and unwards, 3rd April, 1911.

		portion	1120111	- WILL	ngst mose n	1011.				
Particulars.			England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Total, Europe.		
Males Females Persons			••		62.32 61.50 61.99	% 60.97 64.69 62.44	58.60 57.13 58.00	% 53.58 51.62 52.60	% 53.19 66.58 56.65	% 58.90 58.73 58.83

TOTAL, CHRISTIAN

TOTAL, NO RELIGION .. ...

(viii.) Religion.—Details concerning the religions of the European-born population are as follows:—

Religions of European-born (Sexes combined), 3rd April, 1911.

COUNTRY OF BIRTH.

93,037

140,651

70,558

538

74,824

3,089

673.006

658,550

RELIGION. Total Rest of Europe. England. Wales. Scotland. Ireland. Europe. CHRISTIAN-Church of England 206.175 4,805 7,365 19,913 12,791 251,049 Presbyterian Methodist ... 14,298 67,765 3,801 . . 1.020 12,307 98,031 52,679 2,179. . 3.645 2.838 65,142Baptist 12,113 1,396 598 1,818 16.890 965 Congregational Lutheran Church of Christ . . 9,433 1,054 1,738 436 13,098 437 . . 11 774 22,603 11 22,699  $3.04\tilde{1}$ 113 260 4,509 3,962 321 Salvation Army ... Seventh Day Adventist 2.911 389 . . 104 235 323 623 . . 13 72 67 101 153 962Unitarian Unitarian ... Protestant (undefined) Roman Catholic Greek Catholic 766 80 1,017 28,72086 17.970 • • • 638 3,636 1,493 4,983 15,859 451 3.947 15,963 2,007 2,520 94,973 131,193 2,013 10,182 Catholic (undefined) 1,508 34 . . . . 322 5,798 Others 4,718 308 1.290 840 1,927 9,083

12.134

MON CITATORIA M							
NON-CHRISTIAN-							
Hebrew		2,886	23	47	19	2,968	5,943
Confucian		1	-	-;	10	2,500	
Mohammedan		8	•••	- 1	• •	• • • • • • •	2
Buddhist				•• .	•• _	19	27
	••	16	I į	4	1	3	25
	• • •	4		6	1	3	14
Others	• • • • • • • • • • • • • • • • • • • •	240	8	44	24	49	365
Total, Non-Christian	N .	3,155	32	102	45	3,042	6,376
		-,		102	40	3,042	0,370
$INDEFINITE \longrightarrow$							
Freethinker		709	22	171	129	263	1,294
Agnostic		760	21	211	125	142	
No Denomination		419	10	76			1,259
Othore					50	47	$\boldsymbol{602}$
Officers	••	1,214	37	223	128	234	1,836
Total, Indefinite		3,102	90	681	432	686	4,991
					102	000	4,001
NO RELIGION—							
No Religion		1,659	57	388	219	454	2,777
Atheist 🌠		117	2	28			
Others		47			13	72	232
	•••	47	3	13	5	12	80

342,170

The religion percentage of total population for each country of birth is shewn in the succeeding table :—

62

12,318

429

94,249

237

141,365

1,823

350,250

Religion percentage for each Country of Birth, 3rd April, 1911. COUNTRY OF BIRTH. RELIGION. Total, Rest of England. Wales. Scotland. Ireland. Europe. Europe. CHRISTIAN-39.01 37.30 14.57 $\substack{\%\\7.82}$  $\overset{\%}{14.09}$  $\overset{\%}{17.10}$ 58.86 Church of England Presbyterian  $8.28 \\ 17.69$  $8.70 \\ 2.58$ 4.08 . . . . 71.90 3.53 Methodist ... 15.04 . . 4.03 3.79 9.68 Baptist 3.46 2.69 11.33 1.93 .42 1.29 2.51 Congregational Lutheran . . ٠. 8.56 1.84 1.95 .58 . . .02 .01 .01 30.21 .01 Church of Christ ... .87 .92 .82 .43 .67 Salvation Army Seventh Day Adventist .84 .41 .11 .83 ٠. .43 .59 . . .05 .21 .14 Unitarian .22 .08 .05 .11 .15 Protestant (undefined) Roman Catholic Greek Catholic 5.13 5.18 . . 3.86 1.06 6.66 4.274.53 $21.33 \\ 2.68$ ٠. 3.66 4.19 67.18 19.49 ..34 ... .30 Catholic (undefined) .43 . . . . 4.10 3.37 1.51 Others 1.35 2.50 1.37 .59 2.58 1.35 TOTAL, CHRISTIAN 97.69 . . 98.51 98.71 99.49 94.30 97.85 NON-CHRISTIAN-Hebrew .82 .19 .05 .01 3.97 .88 Confucian Mohammedan . . .01 . . .03 Buddhist .01 . . . . .01 ٠. .01 Pagan Others .07 .06 .05 .02 .06 .06 Total, Non-Christian .90 .26 .11 .03 4.06 .95

Religion Percentage for each Country of Birth-continued.

			COUNTRY OF BIRTH.							
Religion.		England.	Wales.	Scotland.	Ireland.	Rest of Europe.	Total, Europe			
INDEFINITE—						,				
Freethinker		 .20	.18	.18	.09	.35	.19			
Agnostic		 .22	.17	.22	.09	.19	.19			
No Denomination		 .12	.08	.08	.04	.07	.09			
Others	• •	 .35	.30	.24	.09	.31	.27			
Total, Indefinite	٠.	 .89	.73	72	.31	.92	.74			
NO RELIGION—										
No Religion		 .48	.46	.42	.16	.61	.41			
Atheist		 .03	.02	.03	7	.10	.04			
Others	• •	 .01	.02	.01	$\int$ .01 $\lfloor$	.01	.01			
Total, No Religion	ī	 .52	.50	.46	.17	.72	.46			
TOTAL		 100.00	100.00	100.00	100.00	100.00	100.00			

Of those born in England the denomination most largely represented was the Church of England, the Methodist ranking second. Similarly for Wales the leading denominations were Church of England, Methodist and Baptist, for Scotland, Presbyterian and Church of England, for Ireland, Roman Catholic and Church of England, and for the Rest of Europe, Lutheran, Roman Catholic and Church of England.

The relative proportions of males and females for each religion and birthplace are shewn in the next table :—

Masculinity of Religious Adherents of European Birth. (Excess of Males over Females per 100 of the sexes combined). 3rd April, 1911.

D			Coun	TRY OF BIR	гн.		Total, Europe.
Religion.		England.	Wales.	Scotland.	Ireland.	Rest of Europe.	
CHRISTIAN-	,						
Church of England		22.57	24.08	2.97	43	39.94	21.08
Presbyterian		6.97	23.53	21.71	16.03	44.41	19.47
Methodist		5.18	16.75	-11.23	14.95	27.06	
Baptist		54	9.74	-6.49	19.06	13.78	4.44
Congregational		4.02	16.70	- 7.83	-21.56		3.21
Lutheran		- 12.33	100.00			21.74	
Church of Christ		- 8.65	4.42	27.27	9.09	41.57	41.37
Salvation Army		2.99		- 4.13	<b> 27.69</b>	24.61	- 6.28
Seventh Day Adventist		- 25.20	11.54	<b>— 14.14</b>	10.64	32.51	3.13
Unitarian			- 53.85	.99	33.33	1.96	<b>— 19.13</b>
Protestant (undefined)	٠٠ .,	28.72	66.67	42.50	58.21	67.44	35.69
Roman Catholic	• • • • • • • • • • • • • • • • • • • •	31.76	43.57	38.23	16.54	64.16	37.67
Greek Catholic	• • • • • •	21.37	13.97	10.87	1.10	58.83	9.32
Catholic (undefined)	• • • • •	33.33			33.33	82.66	82.41
	••	19,63	11.76	19.25	<b>→ 4.14</b>	58.97	15.79
•••	••	3.98	9.74	6.67	9.52	50.91	15.03
Total, Christian		17.54	20.36	17.37	.07	47.67	17.07
NON-CHRISTIAN							
Hebrew		15.32	56.52	10.15	1 7 70	90.05	99.45
Confucian	• • • • •	-100.00		19.15	15.79	29.85	22.67
Mohammedan		- 25.00	• •	100.00	••		.00
Buddhist		75.00	100.00	100.00	100.00	89.47	<b>5</b> 5.56
Pagan		100.00	100.00	100.00	100.00	33.33	76.00
Ou Lann				100,00	100.00	100.00	100.00
	••	13.33	75.00	36.36	25.00	51.02	23.29
Total, Non-Christian	18	15.44	62.50	35.29	11.11	30.64	23.21
NDEFINITE—							
Freethinker	,	79.13	90.91	78.95	73.64	80.23	78.98
Agnostic		79.47	61.90	83.89	87.20	80.28	80.78
No Denomination		31.74	20.00	50.00	36.00	82.98	38.21
Others		39.21	62.16	50.67	31.25	70.09	44.44
Total, Indefinite		57.19	64.44	67.99	60.65	76.97	61.81
TO RELIGION-				· <del></del>		<del></del>	
No Religion		72.03	89.47	01.44	07.91	04.50	#0 C =
Atheist		84.62		81.44	87.21	84.59	76.95
Othorn	•• ••	74.47	$100.00 \\ 100.00$	100.00 100.00	69.23 $100.00$	$91.67 \\ 83.33$	$87.93 \\ 82.50$
TOTAL, No RELIGION		72.88	90.32	83.22	86.50	85.50	77.92
TOTAL		18.16		<u> </u>			
	• • • • • • • • • • • • • • • • • • • •	19.10	21.14	18.06	.40	47.52	17.74

17. Asiatic-born Population.—To the total of 36,822 from Asiatic birthplaces, China, British India, Japan and Syria were, in the order named, the largest contributors, the Chinese with 20,994 representing 57 per cent. of the Asiatic total. Particulars for the principal Asiatic birthplaces are as follows:—

Asiatic-born Population according to Countries of Birth, 3rd April, 1911.

	Ma	LES.	FEM	ALES.	PER	SONS.	Masculinity (Excess of males over females per 100 of sexes combined)	
BIRTHPLACE.	Number.	Per 1000 of male population	Number.	Per 1000 of female population	Number.	Per 1000 of total population		
ASIA—					0		<b>70.00</b>	
British India	5,102	2.21	1,610	.75	6,712	1.51	52.03	
Cevlon	477	.21	140	.06	617	.14	54.62	
Hong Kong	359	.15	59	.03	418	.09	71.77	
Straits Settlements	648	.28	61	.03	709	.16	82 79	
Other Asiatic Brit. Poss.	154	.07	37	.02	191	.04	61.26	
Afghanistan	202	.09			202	.05	100.00	
Arabia	33	.01	2	.00	35	.01	88.57	
China	20,669	8.94	325	.15	20,994	4.71	96.90	
<del>-</del>	3,294	1.42	216	.10	3,510	.79	87.69	
- ·	541	.23	43	.02	584	.13	85.27	
TO 1 121 1 T 1 1.	428	.18	20	.01	448	.10	91.07	
	904	.39	638	.30	1,542	.35	17.25	
Syria Other Asiatic Countries	824	.36	36	.02	860	.19	91.63	
Total, Asia	33,635	14.54	3,187	1.49	36,822	8.27	82.69	

The distribution of the Asiatic-born population over the several States and Territories of the Commonwealth is shewn in the following table, those born in the four countries most numerously represented being separately shewn:—

Asiatic-born Population according to States and Territories in which Resident, 3rd April, 1911.

STATES AND TERRITORIES.	China.	British India.	Japan.	Syria.	Other Asiatic Countries.	Total, Asia.
	<u>'</u>	MALES.				
STATES—						
New South Wales	7,586	1,782	126	<b>453</b>	546	10,493
Victoria	4,296	1,191	48	188	284	6,007
Queensland	5,437	636	1,401	72	908	8,454
South Australia	232	551	17	128	114	1,042
Western Austrlaia	1,625	756	1,616	29	1,645	5,671
Tasmania	358	177	1	33	17	586
rerritories-					1	
<del></del>	1.134	7	85		151	1,377
	, - <sub>1</sub>	2		. 1	1	5
Federal	1					
TOTAL	20,669	5,102	3,294	904	3,666	33,635
	FI	EMALES.	,		1 , , ,	
			.			
STATES—	101	523	14	310	139	1.087
New South Wales	101	431	10	139	108	745
Victoria	57		66	80	73	492
Queensland	81	192	5	59	16	213
South Australia	11	122	-	26	38	395
Western Australia	20	195	116	$\frac{20}{24}$	22	201
Tasmania	9	146	• •	24	22	201
rerritories		_	_		2	54
Northern	46	1	5	• •	_	
Federal		• • •	• •	• •		• •
TOTAL	325	1,610	216	638	398	3,187
		PERSONS				
		1			<u> </u>	
STATES—		0.007	140	763	685	11,580
New South Wales	7,687	2,305	140		392	6,752
Victoria	4,353	1,622	58	327		8,732
Queensland	5,518	828	1,467	152	981	
South Australia	243	673	22	187	130	1,255
Western Australia	1,645	951	1,732	5 <u>5</u>	1,683	6,066
Tasmania	367	323	1	57	39	787
FERRITORIES					1	1 /01
Northern	1,180	8	90		153	1,431
Federal	1,10°	2	• • •	1.	1	ŧ
	20.004	6,712	3,510	1,542	4,064	36,822
Total	20,994	0,114	0,010	1,012	-,00-	,

- 18. African-born Population.—Of the total of 4995 African-born population, no fewer than 3957, or 79 per cent. were from South Africa. Of this latter number 2050 were males, and 1907 were females. The majority of these gave as birthplace simply "South Africa." Of the cases in which the province of birth was specified the Cape appeared most frequently, and the Orange Free State least often. The only other African country extensively represented was Mauritius with a total of 662.
- 19. American-born Population.—The only American countries at all largely represented in the Australian population were the United States with a total of 6714, and Canada with a total of 2977, these two countries together accounting for 85 per cent. of the total for America. The former figure comprised 4499 males and 2215 females, while the Canadian total was made up of 2150 males and 827 females.
- 20. **Polynesian-born Population.**—Of the total of 3439 for the various Polynesian birth places 2500 were males and 939 were females. The largest contributor to the total was the Fiji Group, followed by "South Sea Islands" undefined, then New Caledonia and the New Hebrides.
- 21. Population Born at Sea.—The total number born at sea was 4289, of whom 2236 were males, and 2053 were females.

### CHAPTER XII.

# LENGTH OF RESIDENCE.

- 1. Form of Inquiry.—One of the inquiries made on the "personal" card at the present census was that relating to the length of residence in the Commonwealth, asked in the case of persons born outside Australia. As in the case of the inquiry relative to age, the question was duplicated, the first requisition being: "If born outside Commonwealth, state length of residence therein"; while the second was: "Date of arrival in Commonwealth." In cases where both forms of inquiry on the card were replied to, and the replies were discordant, the rule followed in tabulation was that of accepting the statement as to date of arrival in preference to that specifically stating duration of residence. This was the first occasion on which information relating to length of residence in Australia had been obtained by means of a census. At the Census of 1901 each of the States asked for information in respect of length of residence within its own boundaries, but particulars in respect of length of residence in Australia as a whole were not obtained.
- 2. **Objects of Inquiry.**—The inquiry relative to Length of Residence is one which, prior to to Census of 1901, had only on rare occasions been made in the censuses of the Australian States. The main reason for its inclusion on that and the present occasions was undoubtedly the bearing which the results of the inquiry have on the question of Old Age Pensions in Australia, since one of the conditions of grant of such pensions is at present a residence of 20 years in Australia, while under the State regime it was as much as 25 years in certain of the States. In addition to the purpose thus served, the statistics of length of residence furnish interesting and valuable indications of the permanency or otherwise of the migration which has taken place in various periods, and also of the tendency for recent immigration to distribute itself over the metropolitan and extra-metropolitan areas of the several States.
- 3. Length of Residence Unspecified.—Of the total population of 4,455,005 recorded at the Census of 1911, there were 3,667,670 returned as born in Australia. Of the remainder, 727,774 furnished particulars as to length of residence, while 59,561 failed to supply such particulars, some giving a birthplace outside of Australia without furnishing any information as to length of residence, while others failed to supply information as to either birthplace or length of residence. In preparing the census data for analysis for the purposes of the present chapter, the numbers relating to those of unspecified length of residence have been proportionately distributed, care being taken in so doing to make an allowance for Australian-born included therein. As the outcome of this distribution, 21,265 of those of unspecified length of residence were allocated to the Australian-born, and 38,296 to the oversea population, thus giving an oversea total of 766,070. Throughout the present chapter the figures so adjusted have been employed.
- 4. General View of Results.—The data obtained have been tabulated in conjunction with age for each sex for each of the States and Territories of the Commonwealth. The results are contained in Part III., "Length of Residence" of the Detailed Tables. (See Vol. II., pp. 387-439).

The following table furnishes a summary of the results for sex and length of residence :-

Length of Residence in Australia of Oversea Population, 1911.

Length of Residence	Period				TERRIT					
Australia in Years.	of Arrival.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth.
				M.A	ALES.				*	
0–9	1901-1911	40,887	17,950	20,388	7,009	20,261	1,557	179	41	108,272
10–19	1891-1901	15,676	9,600	9,245	2,161	8,008	1,086	163	9	45,948
<b>2</b> 0– <b>2</b> 9	1881-1891	48,491	28,718	34,247	5,710	12,108	2,938	858	24	133,094
<b>30–39</b>	1871–1881	<b>25,481</b>	12,814	16,186	6,951	4,749	1,144	424	20	67,769
40-49	1861-1871	12,420	14,576	10,154	3,397	2,345	722	37	13	43,664
50-59	1851-1861	15,341	23,935	3,902	5,177	1,801	1,611	21	26	51,814
60 & over	before 1851	4,011	3,666	681	2,275	443	434	3	9	11,522
TOTAL		162,307	111,259	94,803	32,680	49,715	9,492	1,685	142	462,083

Length of Residence in Australia of Oversea Population, 1911-continued.

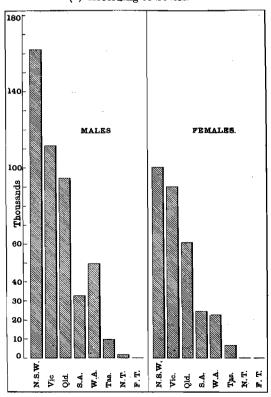
Length of Residence in	Period of				STATI	ES.		TERRIT	C11	
Australia in Years.	Arrival.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth.
				FE	MALES.	·				
0-9 10-19 20-29 30-39 40-49 50-59 60 & over	1901-1911 1891-1901 1881-1891 1871-1881 1861-1871 1851-1861 before 1851	19,354 8,341 31,960 14,683 8,543 12,998 4,210	9,946 5,688 18,939 8,937 15,837 26,323 4,312	10,358 4,580 24,635 10,337 7,549 2,482 483 60,424	2,153 1,132 4,093 4,981 2,892 5,994 2,816	7,937 3,788 5,369 1,964 1,448 1,478 342	1,020 649 2,006 611 555 1,599 504	17 31 36 6 4 4 1	9 6 14 8 4 15 6	50,794 24,215 87,052 41,527 36,832 50,893 12,674
N-may.			<u> </u>	P	ERSONS.					1
0-9 10-19 20-29 30-39 40-49 50-59 60 & over	1901-1911 1891-1901 1881-1891 1871-1881 1861-1871 1851-1861 before 1851	60,241 24,017 80,451 40,164 20,963 28,339 8,221 262,396	27,896 15,288 47,657 21,751 30,413 50,258 7,978	30,746 13,825 58,882 26,523 17,703 6,384 1,164	9,162 3,293 9,803 11,932 6,289 11,171 5,091	28,198 11,796 17,477 6,713 3,793 3,279 785	2,577 1,735 4,944 1,755 1,277 3,210 938	196 194 894 430 41 25 4	50 15 38 28 17 41 15	159,066 70,163 220,146 109,296 80,496 102,707 24,196

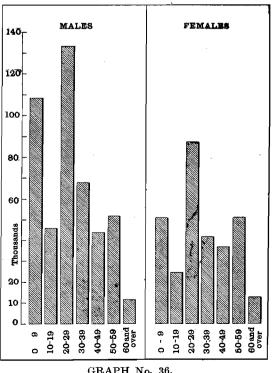
It will be seen from the foregoing table that the decennial period which contributed most largely to the oversea population of Australia in 1911 was that from 1881 to 1891, the recorded contribution from that decennium being more than 60,000 in excess of that from the decennium from 1901 to 1911, which ranked next in importance, and more than twice as great as that from 1871 to 1881, which ranked third. When comparing in this manner the contributions from past decennia, it must be borne in mind that the more remote the decennium under review the greater will be the reductions effected by death in the numbers contributed by it. Another point to be observed in this matter is the fact that the returns for those having a length of residence less than one year include a very large number of persons who have come to Australia for purposes other than permanent settlement, such for example as the crews of oversea vessels, commercial travellers from abroad, tourists, etc. Thus, whilst the total recorded at the date of the census having less than one year's length of residence was 56,138, the corresponding figure for one year and less than two was 26,453. This difference was no doubt in part due to expanding immigration, but it was also due in no small measure to the inclusion of "birds of passage."

#### Oversea Population of Australia, 1911.

(a) According to States.

(b) According to length of Residence.





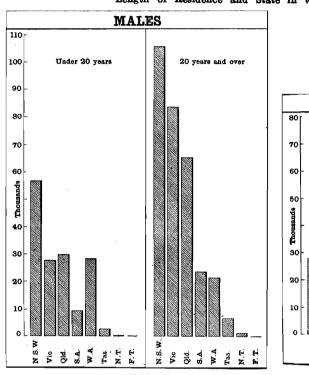
GRAPH No. 35.

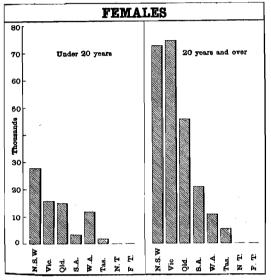
GRAPH No. 36.

The accompanying Graphs (Nos. 35 and 36) furnish representations of the number of the oversea population, distributed in Graph No. 35, according to the States in which they were resident at the date of enumeration, and in Graph No. 36 according to their length of residence. The figures shewn beneath the columns in Graph No. 36, denote the number of completed years of residence in Australia.

The succeeding graphs (Nos. 37 and 38) furnish a representation of length of residence combined with geographical distribution, the results represented being the numbers of each sex recorded in each State, who had been resident in Australia "under 20 years" and "20 years and over."

Length of Residence and State in which Enumerated, 1911.





GRAPH No. 37.

GRAPH No. 38.

These graphs furnish an interesting view of the marked growth from oversea in the populations of New South Wales, Queensland and Western Australia during the 20 years prior to the date of the Census.

The following table shews the proportion per cent. of the oversea population of each of the States and Territories which was contained in each of the length of residence groups specified in the foregoing table.

Distribution per cent. of Oversea Population according to Length of Residence in Australia, 1911.

Length of Residence in	Period of				TERRIT	C'wlth.				
Australia in Years.	Arrival.	N.S.W.	Vic. %	Q'land.	S.A. %	W.A. %	Tas. %	N.T. %	<b>г.т.</b> %	O WLIH.
	·	. , , , ,	70		ALES.	,,0				
0-9 10-19 20-29 30-39 40-49 50-59 60 & over	1901-1911 1891-1901 1881-1891 1871-1881 1861-1871 1851-1861 before 1851 ATIONS	25.19 9.66 29.88 15.70 7.65 9.45 2.47 100.00	16.13 8.63 25.81 11.52 13.10 21.51 3.30	21.51 9.75 36.12 17.07 10.71 4.12 .72	21.45 6.61 17.47 21.27 10.40 15.84 6.96	40.75 16.11 24.36 9.55 4.72 3.62 .89	16.41 11.44 30.95 12.05 7.61 16.97 4.57	10.62 9.67 50.92 25.16 2.20 1.25 .18	28.87 6.34 16.90 14.08 9.16 18.31 6.34	23.43 9.95 28.80 14.67 9.45 11.21 2.49
			***************************************	FEM	ALES.	'				
0-9 10-19 20-29 30-39 40-49 50-59 60 & over	1901-1911 1891-1901 1881-1891 1871-1881 1861-1871 1851-1861 before 1851	19.34 8.33 31.93 14.67 8.53 12.99 4.21	11.05 6.32 21.05 9.93 17.60 29.26 4.79	17.14 7.58 40.77 17.11 12.49 4.11 .80	8.95 4.71 17.01 20.70 12.02 24.91 11.70	35.55 16.97 24.05 8.80 6.48 6.62 1.53	14.69 9.34 28.89 8.80 7.99 23.03 7.26	17.17 31.31 36.37 6.06 4.04 4.04 1.01	14.52 9.68 22.58 12.90 6.45 24.19 9.68	16.71 7.96 28.64 13.66 12.12 16.74 4.17

Distribution per cent. of Oversea Population according to Length of Residence in Australia, 1911-continued.

Length of Residence in Australia in Years.	Period of Arrival.				TERRIT					
		N.S.W.	Vic. %	Q'land.	S.A. %	W.A. %	Tas. %	N.T. %	F.T. %	C'wlth.
				PEI	RSONS.					
0-9	1901–1911	22.96	13.86	19.81	16.15	39.14	15.68	10.99	24.51	20.76
10–19 20–29	1891–1901 1881–1891	$9.15 \\ 30.66$	$7.60 \\ 23.68$	8.91 37.93	$\begin{array}{c} 5.80 \\ 17.28 \end{array}$	$\begin{array}{c} 16.37 \\ 24.26 \end{array}$	$10.55 \\ 30.08$	$\begin{array}{c c} 10.88 \\ 50.11 \end{array}$	7.35 $18.63$	9.16 28.74
30-39	1871-1881	15.31	10.81	17.09	21.03	9.32	10.68	$24.10 \\ 2.30$	$13.73 \\ 8.33$	14.27 10.51
40–49	1861-1871 1851-1861	$\begin{array}{c c} 7.99 \\ 10.80 \end{array}$	15.11 $24.97$	11.40 4.11	11.08 19.69	5.27 4.55	$\begin{array}{c} 7.77 \\ 19.53 \end{array}$	$\begin{array}{c} 2.30 \\ 1.40 \end{array}$	20.10	13.40
60 & over	before 1851		3.97	.75	8.97	1.09	5.71	.22	7.35	3.16
ALL DUE	ATIONS	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

For the Commonwealth as a whole 29.92 per cent. of the oversea population had been resident in Australia for less than 20 years. This proportion varied in the several States and Territories, being 32.11 per cent. for New South Wales, 21.46 per cent. for Victoria, 28.72 per cent. for Queensland, 21.95 per cent. for South Australia, 55.51 per cent. for Western Australia, 26.23 per cent. for Tasmania, 21.87 per cent. for the Northern Territory, and 31.86 per cent. for the Federal Territory. The periods of maximum contribution were 1901-11 in the cases of Western Australia and the Federal Territory, 1881-91 in the cases of New South Wales, Queensland, Tasmania, the Northern Territory, and the Commonwealth as a whole, 1871-81 in the case of South Australia, and 1851-61 in the case of Victoria.

4. Comparison with Migration Statistics.—A comparison of the length of residence statistics with those of immigration for corresponding periods would furnish interesting results, but unfortunately the data relative to oversea immigration to Australia for early years is not readily available. The following table, however, gives the particulars as to net oversea immigration for the period 1861-1911, in comparison with the length of residence statistics, and furnishes some results of importance.

Net Immigration and Length of Residence.

		Males.			FEMALES.		Persons.		
PERIOD.	Net Immi- gration*	Survivors at Census of 1911 of vivors to immigrants during migraperiod.		Net Immi- gration*	Survivors at Census of 1911 of immigrants during period.	t Census of Sur- f 1911 of vivors to unigrants net im- during migra-		Survivors at Census of 1911 of immigrants during period.	
1861–1871 1871–1881 1881–1891 1891–1901 1901–1911	79,476 124,195 244,284 14,715 30,822	43,664 67,769 133,094 45,948 108,272	.549 .546 .545 3.123 3.513	87,414 67,609 138,457 10,164 9,663	36,832 41,527 87,052 24,215 50,794	.421 .614 .629 2.382 5.257	166,890 191,804 382,741 24,879 40,485	80,496 109,296 220,146 70,163 159,066	.482 .570 .575 2.820 3.929

<sup>\*</sup> These figures relate to the decennia ended 31st December, 1870, 1880, etc.

As indicated above, the absence of complete statistics of oversea immigration prevents the preparation of a satisfactory comparison between the migration and the length of residence The figures for net immigration have been compiled from the returns of the several States, in which, although oversea and interstate migration for the earlier years are not separately shewn, the subtraction of the aggregate departures from the aggregate arrivals necessarily eliminates the interstate element and leaves for the Commonwealth as a whole the net immigration from oversea. If the departures consisted entirely or even mainly of what have been termed "birds of passage," a fairly satisfactory comparison would be furnished by the net result, but as the departures include many Australian-born, as well as oversea population of considerable length of residence, the utmost that can be obtained are general indications. A marked feature of the table is the distinction drawn between the period 1861-91 and the period During the earlier period of 30 years the net immigration to Australia totalled 741,435, while the total number of survivors at the Census of 1911 of those who arrived during the period was 409,938, the survivors thus representing about 55 per cent. of the net immigration. For the latter period of 20 years from 1891-1911, however, the position is very different, the total net immigration being 65,364, and the total number of survivors of those who arrived during the period being 229,229, or 3½ times the net immigration for the period. Allowing for deaths amongst the oversea population, these figures indicate that during the 20 years 1891-1911,

Australia, while receiving an immigration of upwards of 250,000 persons from outside, must have experienced an emigration of upwards of 180,000, who were either native-born, or had settled in Australia prior to 1891. Some of the causes contributing to this outflow were the commercial depression of 1891 and subsequent years, the financial crisis of 1893, the South African war of 1899-1902 and the drought of 1902-3.

For the ten years from 1st April, 1901, to 31st March, 1911, more complete details are available than can be obtained for the whole of the 50 years dealt with in the preceding table. These details relate to the 5 year period from 1st April, 1901, to 31st March, 1906, and to each of the succeeding five years, 1906-7 to 1910-11. Particulars for this period are available for arrivals and departures as well as for the net immigration, but it will be of interest to give first the figures in respect of net immigration for the sake of comparison with the preceding table.

Net Immigration	and	Length	of	Residence.	1901	to 191	1.
	~~~	CHS III	O.	TACSTROTTOO!	TOUT	M TOT	1.

		Males.			FEMALES.		Persons.		
Period.	Net Immi- gration.	Survivors at Census of 1911 of immigrants during period.	Ratic of Sur- vivors to net im- migra- tion.		Survivors at Census of 1911 of immigrants during period.		Net Immi- gration.	Survivors at Census of 1911 of immigrants during period.	
lst 31st April to Mar. 1901 ,, 1906 1906 ,, 1907 1907 ,, 1908 1908 ,, 1909 1909 ,, 1910 1910 ,, 1911	$\begin{array}{r} - & 4,666 \\ - & 3,110 \\ + & 5,620 \\ + & 4,342 \\ + & 16,314 \\ + & 24,909 \end{array}$	6,117 9,831 13,420 18,481	$egin{array}{c}4.107 \1.967 \ +1.749 \ +3.091 \ +1.133 \ +1.656 \end{array}$	$ \begin{array}{rrrr}  & 758 \\  + & 2,899 \\  + & 2,364 \end{array} $	2,785 4,705 6,643 9,283	$egin{array}{c} -3.674 \\ +1.623 \\ +2.810 \\ +1.356 \end{array}$	-15,276 $-3,868$ $+8,519$ $+6,706$ $+23,161$ $+37,225$	8,902 14,536 20,063 27,764	$\begin{array}{c} -1.890 \\ -2.301 \\ +1.706 \\ +2.992 \\ +1.199 \\ +1.583 \end{array}$

Note. - + indicates net immigration; - indicates net emigration.

A more satisfactory comparison of migration and survivors is furnished in the succeeding table, which gives particulars in respect of arrivals instead of net immigration.

Oversea Arrivals and Length of Residence, 1901 to 1911.

		Males.			FEMALES.		Persons.		
Puriod.	Over- sea Arrivals.	Survivors at Census of 1911 of immigrants during period.	Ratio of Sur- vivors to Arrivals.	Over- sea Arrivals.	Survivors at Census of 1911 of immigrants during period.	Ratio of Sur- vivors to Arrivals.		Survivors at Census of 1911 of immigrants during period.	Ratio of Sur- vivors to Arrivals
lst 31st						<del>_</del>			
April to Mar. 1901 1906	192,046	19,164	.100	00.00=	0.504	11-	054 071	20.020	
1000 1000	37,203	6,117		82,605	9,704	.117	274,651	28,868	.105
1007 1000			.164	18,910	2,785	.147	56,113	8,902	.159
	46,371	9,831	.212	23,016	4,705	.204	69,387	14,536	.209
1908 , 1909	51,489	13,420	.261	24,482	6,643	.271	75,971	20,063	.264
1909 ,, 1910	57,871	18,481	.319	25,818	9,283	.360	83,689	27,764	.332
1910 1911	71,762	41,259	.575	33,182	17,674	.533	104,944	58,933	.562

This table furnishes an indication of the large extent to which the recorded arrivals in Australia from oversea countries are merely "birds of passage." Thus of the total of 274,651 who arrived in Australia during the five years ended 31st March, 1906, only 28,868, or  $10\frac{1}{2}$  per cent., were still in Australia at the date of the census. Similarly, less than 16 per cent. of those who arrived during the year 1906-7, and less than 21 per cent. of those who arrived during 1907-8 were still in Australia at the date of the census.

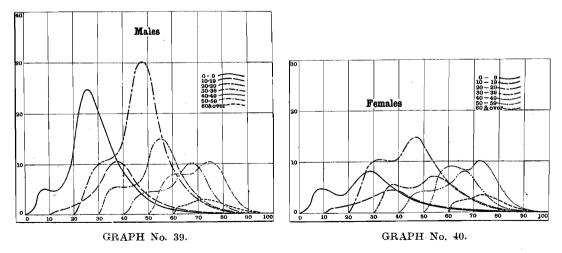
5. Length of Residence and Age.—Particulars respecting length of residence and age in conjunction were tabulated in single years from 0 to 4 and in quinquennial groups thence onwards. Details for each sex, and for the sexes combined are given in respect of the Commonwealth as a whole, and also in respect of each State and Territory on pages 392 to 419 of Volume II., Detailed Tables. A summary of the data in respect of the Commonwealth for some important age groups are as follows:—

Length of Residence and Age, Commonwealth Oversea Population, 1911.

LENGT				AGE LAST BIRTHDAY.								
IN COMPLETED YEARS.				Under 5.	Under 5. 5 to 14. 15 to 44. 45 to 59. 60 to 64.				65 and over.			
MALES.												
0-9				3,754	9,272	86,536	7,239	715	756	108,272		
0-19					555	34,340	9,099	862	1,092	45,948		
0-29						53,344	65,825	6,814	7,111	133,094		
0-39						13,070	35,774	9,673	9,252	67,769		
0-49						1,147	12,932	7,385	22,200	43'664		
0-59					!		9,027	8,580	34,207	51,814		
0 and						• •	0,021	1,459	10,063	11,522		
TT -				0.554	0.00=				<del></del>			
10	<b>FAL</b>	• •	••	3,754	9,827	188,437	139,896	35,488	84,681	462,083		
							<u></u>					
						FEMALES.						
0-9			:	3,563	8,757	32,950	4,206	586	732	50,794		
0-19					565	17,300	4,557	649	1,144	24,215		
0-29				!		43,423	32,664	4,602	6,363	87,052		
0-39						12,394	18,350	4,689	6,094	41,527		
0-49						1,136	12,666	6,731	16,299	36,832		
0-59					1		9,916	9,140	31,837			
0 and				::	• •	• •	3,910	1,626	11,048	50,893 12,674		
				0.500			i					
1.0	FAL	••	• •	3,563	9,322	107,203	82,359	28,023	73,517	303,987		
					]	PERSONS.						
0-9				7,317	18,029	119,486	11,445	1,301	1,488	159,066		
0-19					1,120	51,640	13,656	1,511	2,236	70,163		
0-29						96,767	98,489	11,416	13,474	220,146		
0-39						25,464	54,124	14,362	15,346	109,296		
0-49						2,283	25,598	14,116	38,499	80.496		
0-59					• • • • • • • • • • • • • • • • • • • •		18,943	17,720	66,044	102,707		
0 and		• •			::	• •	10,940	3,085	21,111	24,196		
					<b></b> i			<del></del>	<del></del>			
1.0	TAL	• •		7,317	19,149	295,640	222,255	63,511	158,198	766,070		

The accompanying graphs (Nos. 39 and 40) furnish a representation of the oversea population of Australia at the Census of 1911, distributed according to length of residence and age. The base of each small rectangle represents ten years of age, while the height represents 10,000 persons. The key in each graph indicates the type of curve used for the several durations of residence represented.

Length of Residence and Age, 1911.



The dimorphic or double-headed character of the several curves is due to the fact that the immigrants contain a fair proportion of married persons with children under ten years of age. The fully detailed figures corresponding to the above graphs will be found in Vol. II., pp. 392-3.

6. Survivors from Previous Censuses.—By means of the length of residence data taken in conjunction with statistics of age for the Australian-born population, a close estimate may be made of the number of survivors at the Census of 1911 of those recorded at previous censuses. Such an estimate is given in the succeeding table together with a comparison of the figures so obtained with the results of the Censuses of 1881, 1891 and 1901.

DATE OF CENSUS.		er Recori sus Specii			ATED NUM ORS AT CE 1911.		RATIO PER CENT. OF SURVIVORS TO NUMBER RECORDED.		
	Males.	Females.	Persons.	Males.	Females.	Persons.	Males.	Females	Persons.
3rd April, 1881 5th ,, 1891 31st Mar.,1901	1,704,039	1,470,353	2,250,194 3,174,392 3,773,801	1,238,012	1,165,428		72.65	67.52 - 79.26 90.02	63.74 75.71 88.30

Survivors from 1881, 1891 and 1901, in Commonwealth Population, 1911.

These figures indicate that 63.74 per cent. of the population present in Australia at the Census of 1881 were present at that of 1911, the corresponding percentages for 1891 and 1901 being 75.71 per cent. and 88.30 per cent. respectively. In other words, of the population present in Australia at the Census of 1881, 36.26 per cent. had died or departed in the succeeding 30 years; of those present at the Census of 1891, 24.29 per cent. had died or departed in the succeeding 20 years; while of those present at the Census of 1901, 11.70 per cent. had died or departed during the succeeding 10 years.

Viewed from the opposite standpoint, it may be said that of the population at the Census of 1911, 74.80 per cent. had been present at the Census of 1901, 53.95 per cent. had been present at the Census of 1891, and 32.20 had been present at the Census of 1881. In other words, of the population at the Census of 1911, 25.20 per cent. had arrived or had been born in Australia during the preceding 10 years, 46.05 per cent. had arrived or had been born in Australia during the preceding 20 years, and 67.80 per cent. had arrived or had been born in Australia during the preceding 30 years.

- 7. Advanced Ages.—For the purpose of facilitating estimates for Old Age Pension purposes based on age and length of residence, the data for single ages from 50 to 64 inclusive, and for lengths of residence from 10 to 24 years were tabulated in conjunction. These data appear on pp. 422 to 439 of Volume II. of the Detailed Tables. They are there given for each sex for the Commonwealth and its component States and Territories.
- 8. Eligibility for Old Age Pensions.—Under the present Commonwealth law, the age qualification for males is 65 years, and for females 60 years, whilst the length of residence qualification is in each case 20 years.

In cases of incapacitation the qualifying age for males is reduced to 60 years.

The total recorded number of males aged 65 and upwards at the date of the census was 101,003, of whom 99,155 or 98.17 per cent., had the requisite length of residence qualification.

In the case of females the total number aged 60 and upwards at the date of the census was 135,067, of whom 131,956, or 97.70 per cent., had the necessary residence qualification.

It thus appears that of a total of 236,070 persons qualified in respect of age, 231,111, or 97.90 per cent., were also qualified in respect of length of residence.

The effect as at the date of the census of reducing the general age qualification for males to 60 would be to increase the number of eligible males by 49,054, or 49.47 per cent., and to increase the total number of persons eligible by 21.23 per cent.

It will be understood that the term eligible as here used refers only to age and length of residence. Statistics of eligibility in respect of financial position were, of course, not available in connexion with the census data.

9. Comparison of Pensioners with Eligible Persons.—In the course of an investigation made by the Commonwealth Statistician respecting the mortality experience of old age pensioners, statistics were obtained concerning the number of such pensioners at successive ages at the date of the census. A comparison of the figures so obtained with those relating to eligibility furnished by the length of residence data is given in the following table for quinquennial groups of ages:—

Old Age Pensioners and Eligible Persons as at 3rd April, 1911.

Age Last Birthday.	THAN 20	RESIDENCE	ENGTH OF		er of Oli ners at D Census.		RATIO PER CENT. OF PENSIONERS TO NUMBER HAVING NOT LESS THAN 20 YEARS' RESIDENCE.		
	Males.	Females.	Persons.	Males.	Females.	Persons.	Males.	Females.	Persons.
60 to 64	50,182	43,027	93,209	1,128	5,294	6,422	2.25	12.30	6.89
65 ,, 69	39,618	35,875	75,493	9,026	10,748	19,774	22.78	29.96	26.19
70 ,, 74	28,684	25,590	54,274	11,070	10.507	21,577	38.59	41.06	39.76
75 ,, 79	18,682	16,343	35,025	8,175	7,677	15,852	43.76	46.97	45.26
80 ,, 84	8,767	7,612	16,379	3,583	3,133	6,716	40.87	41.16	41.00
85 ,, 89	2,621	2,656	5,277	982	1,005	1,987	37.47	37.84	37.65
90 ,, 94	634	699	1,333	247	288	535	38.96	41.20	40.14
95 ,, 99	116	125	241	36	37	73	31.03	29.60	30.29
100 and over	33	29	62	13	10	23	39.39	34.48	37.10
Total, 60 & over	149,337	131,956	281,293	34,260	38,699	72,959	22.94	29.33	25.94

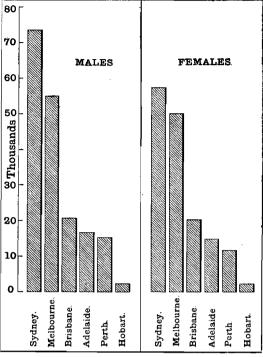
These figures indicate that for all ages, from 60 to 95, the number of female pensioners is a higher proportion of the number of females having the requisite qualifications in respect of age and length of residence than is the case with males. The ratio per cent. of pensioners aged 65 and upwards to the number of such age having not less than 20 years' residence was 33.41 per cent. in the case of males, 37.56 per cent. in the case of females, and 35.38 per cent. for the sexes combined. The corresponding percentages for those aged 70 and upwards were as follows:—Males, 40.49 per cent.; females, 42.71 per cent.; and for the sexes combined, 41.53 per cent.

10. Metropolitan Population.—In Chapter XI., dealing with birthplaces, it was shewn that there was a much greater tendency for the oversea population of the Commonwealth to aggregate in the metropolitan areas, than was the case with the native-born. An analysis of the figures relating to length of residence furnishes evidence that this tendency is much more marked amongst the arrivals of comparatively recent years than is the case with those who emigrated to Australia in the early years of its settlement. The following table furnishes particulars in respect of the numbers for certain grouped lengths of residence, who were resident in the several metropolitan areas at the date of the census.

Metropolitan Population from Oversea Countries, 1911.

Length of Residence in Completed Years,		Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan.	
					MALES.				
0-9			19,671	9,529	4,728	3,218	4,969	475	42,590
10-19		• • •	8,088	5,518	1,506	1,162	2,716	292	19,282
20-29			24,761	17.365	8,479	3,420	4,387	698	59,110
30-39			11,280	6,937	2,979	4,006	1,531	265	26,998
10-49			4,272	5,891	1,990	1,608	840	157	14,758
50-59			4,405	8,463	686	2,222	630	310	16,716
60 and over	• •		975	1,172	110	986	152	109	3,504
TOTAL			73,452	54,875	20,478	16,622	15,225	2,306	182,958
					FEMALES.		1		
0-9			12,530	6,631	3,754	1,673	4,016	404	29,008
	• •	• •	5,374	3,695	1,409	785	1,920	203	13,386
00 00	• •		19,577		8,521	2,861	2,897	616	47.408
00 00	• •	• •		12,936			974	179	21,255
10 10	• •		8,200	5,496	3,063	3,343			
	٠.	٠.	4,290	7,675	2,314	1,572	757	156	16,764
50-59	• •	• •	5,614	11,763	801	3,012	729	432	22,351
60 and over	• •	• •	1,617	1,820	152	1,471	152	164	5,376
TOTAL	• •	• •	57,202	50,016	20,014	14,717	11,445	2,154	155,548
					PERSONS.	'	· · · · · · · · · · · · · · · · · · ·		
0-9			32,201	16,160	8,482	4,891	8.985	879	71,598
10–19			13,462	9,213	2,915	1,947	4,636	495	32,668
20-29			44,338	30,301	17.000	6,281	7,284	1,314	106,518
30-39			19,480	12,433	6,042	7,349	2,505	444	48,253
40-49			8,562	13,566	4,304	3,180	1,597	313	31,522
50-59		• •	10,019	20,226	1,487	5,234	1,359	742	39,067
60 and over			2,592	2,992	262	2,457	304	273	8,880
Тотаг			130,654	104,891	40,492	31,339	26,670	4,460	338,506

#### Metropolitan Oversea Population, 1911.



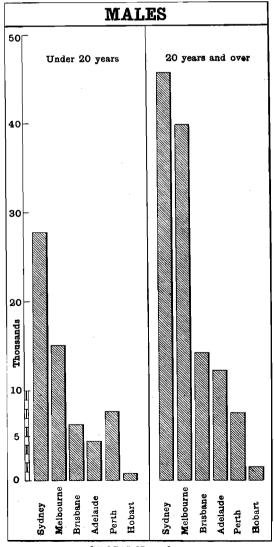
GRAPH No. 41.

In the accompanying graph (No. 41) a representation is furnished of the oversea population of each sex that was resident in the metropolitan centres of the Commonwealth at the Census of 1911. In each case the representation given is that for the specified capital city and its suburbs, usually within a distance of approximately ten miles from the G.P.O.

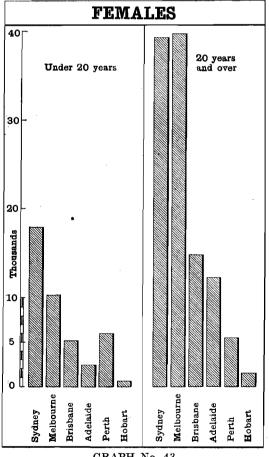
In each case the number of males exceeded the number of females, the difference being most marked in the case of Sydney, and least marked in the cases of Melbourne, Brisbane, and Hobart.

As regards the length of residence the maximum numbers occurred in the period 20-29, in both sexes, in the cases of Sydney, Melbourne, Brisbane, and Hobart; in the period 30-39, in both sexes, in the case of Adelaide; and in the period 0-9, in both sexes, in the case of Perth.

Length of Residence of Metropolitan Oversea Population, 1911.



GRAPH No.



GRAPH No. 43.

The accompanying graphs (Nos. 42 and 43) furnish a further representation of the metropolitan oversea population, distinguishing between those resident in the Common-wealth "under 20 years" and those so resident "20 years and over." The following table shews the proportion per cent. of the population having the lengths of residence specified who were resident in the metropolitan areas of the Commonwealth and the several States:—

Proportion per cent. Resident in Metropolitan Areas, 1911.

Length of Residence in Years.	N.S.W.	Vic. %	Q'land. %	S.A.	W.A.	Tas.	C'wlth.
,			MALES.				
0-9	48.11	53.09	23.19	45.91	24.52	30.51	39.34
10–19	51.59	57.48	16.29	53.77	33.92	26.89	41.96
20-29	51.06	60.47	24.76	59.89	36.23	23.76	44.41
30–39	44.27	54.14	18.40	57.63	32.24	23.16	39.84
10–49	34.40	40.42	19.60	47.34	35.82	21.75	33.80
50–59	28.71	35.36	17.58	42.92	34.98	19.24	32.26
30 and over	24.31	31.97	16.15	43.34	34.31	25.12	30.41
ALL DURATIONS	45.25	49.32	21.60	50.86	30.62	24.29	39.59
		1	FEMALES.				
0-9	64.74	66.67	36.24	77.71	50.60	39.61	57.11
10–19	64.43	64.96	30.76	69.35	50.69	31.28	55.28
20–29	61.25	68.30	34.59	69.90	53.96	30.71	54.46
30–39	55.85	61.50	29.63	67.12	49.59	29.30	51.18
40-49	50.22	48.46	30.65	54.36	52.28	28.11	45.51
50-59	43.19	44.69	32.27	50.25	49.32	27.02	43.92
30 and over	38.41	42.21	31.47	52.24	44.44	32.54	42.42
ALL DURATIONS	57.15	55.58	33.12	61.17	51.26	31.02	51.17
	;		PERSONS.				1
0-9	59.45	£7.02	27.59	53.38	31.86	34.11	45.01
10 10	53.45	57.93	27.59 21.08	59.13	39.30	28.53	46.56
20.00	56.05	60.26	28.87	64.07	41.68	26.58	48.39
00.90	55.11	63.58	28.87 22.78	61.59	37.32	25.30	44.15
10. 10	48.50	57.16 $44.61$	24.31	50.56	42.10	24.51	39.16
EO EO	40.84		23.29	46.85	41.45	23.12	38.04
20 1	35.35	40.24			38.73	$\frac{23.12}{29.10}$	36.70
30 and over	31.53	37.50	22.51	48.26	30.13	23.10	30.70
ALL DURATIONS	49.79	52.12	26.09	55,23	37.02	27.14	44.19

It will be seen from the foregoing tables that taking the Commonwealth as a whole, a larger proportion of those who have arrived in Australia during the last 30 years are residents of metropolitan areas than is the case with those who arrived here upwards of 30 years ago. Thus, of 449,375 who arrived within the period 1881-1911, a total of 210,784, or 46.91 per cent., were resident in metropolitan areas, while of 316,695 who arrived prior to 1881, the number resident in metropolitan areas was 127,722, or 40.33 per cent. As previously stated the proportion of the native-born resident in metropolitan areas was 36.75 per cent.

# CHAPTER XIII.

## EDUCATION.

- 1. Nature and Scope of Inquiry.—The Census and Statistics Act, 1905, specifies "Education" as one of the subjects concerning which inquiry shall be made at the taking of a Census of the Commonwealth, but gives no indication of the range of the inquiry to be made. In the past it has been usual in Australia to restrict the inquiry to a query as to ability to read and write, with occasionally an additional request that in the event of the person enumerated being a University graduate the degree and the name of the University should be stated. From the nature of the case it is clear that a general inquiry concerning education made in connexion with a Census must necessarily be limited in its range, and it has been found on the present occasion that even the question relating to University degrees is by no means suitable. The query on the Census card appeared in the following form:—
  - "13. Education.....
  - "13. (a) At present receiving Education...."

The corresponding instruction furnished therewith was as follows:—

- "Line 13.—Write CR for cannot read, R for read only, and RW for read and write. If "not able to read English, but able to read a foreign language write RF, and if not able to read and write English but able to both read and write a foreign language "write RWF.
- "If the person to whom the card relates has obtained a University degree, state the degree, and give the name of the University and country in which it was obtained.
- "Line 13 (a).—Write U if at University, S if at State School, P if at any other school, and "H if being educated at home. Give name of school."

As 13 (a) refers to persons in receipt of education at the date of the Census, it will be dealt with more fully in the succeeding chapter on "Schooling."

The inquiry relative to University degrees elicited replies which defied satisfactory tabulation. Not only were there many cases in which known holders of degrees had failed to furnish the desired information, apparently through failure to carefully read the instructions, but there were many cases in which existing and non-existent degrees of existing and non-existent Universities were recorded as possessed by persons whose acquaintance with a University must have been a negligible quantity. In one instance a camp of half-caste aboriginals had all returned themselves as Bachelors of Science.

The cards relating to alleged holders of University degrees were sorted out for tabulation, but after a careful examination of the material so available it was decided that a tabulation of such data would not only be labour wasted, but would be actually misleading.

As regards the other general education inquiry, viz., the ability to read and write in English or other language, it may be doubted whether such an inquiry is of sufficient importance to warrant its inclusion in the Census schedule. With the enforcement of compulsory education the number of cases in which persons reach mature age unable to read is necessarily very small and relatively insignificant.

As previously indicated, the making of an elaborate inquiry as to education would be impracticable in connexion with a Census. It would consequently appear desirable to drop the question entirely and to substitute for it an inquiry on some other subject likely to lead to more serviceable results.

2. Tabulation of Data.—In accordance with the usual Australian practice the data have been tabulated for States and Territories and the main divisions thereof according to education, sex and age in combination. It was considered, however, that no useful purpose would be served by continuing the usual practice of tabulating the data for each of the categories in quinquennial age groups to the extremes of old age, since, except under very rare circumstances, persons who had reached the age of 20 without being able to read or write would remain illiterate throughout life. It was consequently decided to limit the age groups to (i.) under 5; (ii.) 5–9; (iii.) 10–14; (iv.) 15–19; (v.) 20 and upwards; and (vi.) unspecified; thus effecting a saving of fully 50 per cent. in space and more than that in labour without in any way detracting from the real value of the results. The tabulated details appear on pp. 441 to 621 of Volume II., Detailed Tables.

In classifying the data for this tabulation a rule was made that all children under the age of 5 should be classed as unable to read, since the degree of proficiency attained in the first five years is usually so small as to be negligible.

- 3. Education Unspecified.—Of the various items of inquiry on the personal card there was none which furnished so large a proportion of unspecified as did that relating to Education. Notwithstanding the facts (i.) that all children under 5 years of age, whether specified as to education or not, were classified as unable to read, (ii.) that all unspecified persons whose occupations were such as to render writing necessary were classed as able to read and write, and (iii.) that all unspecified children above 5 years of age who were returned as attending school at the date of the Census were classified as able to read and write, there were still 95,727 tabulated as unspecified, representing 2.15 per cent. of the total population, or 2.44 per cent. of the population aged 5 years and upwards. For the purposes of the analyses contained in the present chapter, the numbers relative to the unspecified have been proportionately distributed over the other categories, special attention being given to the question of birthplace in the case of ability to read or write a foreign language only.
- 4. General Results.—The numbers of each sex possessing the specified degrees of education in the several States and Territories of the Commonwealth at the Census of 3rd April, 1911, were as follows:—

#### Degree of Education, 1911.

DEGREE OF EDUCATION.			Sī	Terri				
	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas	N.T.	F.T.

#### MALES.

English Language—				[		1			
Read and Write	712,051	559,721	270,621	173,126	133,004	78,398	1,148	999	1,928,907
							1,140		
Read only	2,650	1,311	1,170	573	326	473	4	9	6,516
Foreign Language only	,	,							
Read and Write	6,899	4,199	7,172	1,343	5,155	211	898	2	25,879
Read only	593	631	803	120	365	24	32		2,568
Cannot Read	135,505	89,729	49,740	32,196	22,715	18,485	652	143	349,165
m	050 000	055 503	200 500	905 950	101 707	07 501	0.504	000	9 9 1 9 9 9 5
TOTAL	857,698	655,591	329,506	207,358	161,565	97,591	2,734	992	2,313,035
	l	1	1	i	- 1	1			

#### FEMALES.

						-	·		
English Language—	Į.		1			j	)		
Read and Write	660,566	571,570	228,949	169,374	99,114	76,806	320	584	1,807,283
Read only	3,250	2,729	1,307	1,027	266	424		5	9,008
Foreign Language only		-	·						-
Read and Write	680	699	1,842	555	332	32	42		4,182
Read only	64	70	262	92	15	4			507
Cannot Read	$124,\!476$	84,892	43,947	30,152	20,822	16,354	214	133	320,990
Total	789,036	659,960	276,307	201,200	120,549	93,620	576	722	2,141,970
	Į.		1	Į.	Į.	į	1		

# PERSONS.

1	1								
_			ĺ				[		
	1,372,617	1,131,291	499,570	342,500	232,118	155,204	1,468	1,422	3,736,190
	5,900	4,040	2,477	1,600	592	897	4	14	15,524
nlv	,	1	, l						•
	7.579	4.898	9,014	1,898	5,487	243	940	2	30,061
	657	701	1,065	212	380	28	32		3,075
	259,981	174,621	93,687	62,348	43,537	34,839	866		
	1,646,734	1,315,551	605,813	408,558	282,114	191,211	3,310	1,714	4,455,005
	nly	1,372,617 5,900 nly 7,579 657 259,981	1,372,617 1,131,291 5,900 4,040 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,00	$\begin{array}{c} \\ 1,372,617 \\ 5,900 \\ \text{nly} \\ \\ 7,579 \\ 657 \\ \hline 701 \\ 1,065 \\ \hline \\ 259,981 \\ 174,621 \\ 93,687 \\ \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

The number of persons able to "read and write" or "read only" in a foreign language, but not in English, was 33,136, or about 7.5 per thousand of the population, while the number able to "read only" in English was 15,524, or about 3.5 per thousand. On the other hand the number able to read and write English aggregated 3,736,190, or about 84 per cent. of the total. This position is further accentuated if the population under five years of age be eliminated from consideration. Thus the total number and proportion of persons unable to read, but above the age of 5 years, were as follows:—

Number and Proportion above 5 Years of Age Unable to Read, 1911.

			ST.	,,,,	TERRI				
Particulars.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH.

#### NUMBER UNABLE TO READ.

Males Females		 33,261 25,405	16,451 14,270	11,936 7,903	8,043 6,678	4,963 3,546	5,812 4,175	568 127	58 36	81,092 62,140
Perso	NS	 58,666	30,721	19,839	14,721	8,509	9,987	695	94	143,232

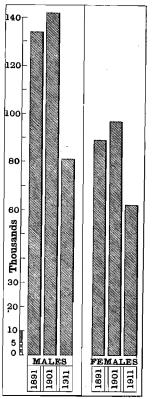
# PROPORTION PER CENT. OF POPULATION ABOVE 5 YEARS.

				<del></del>							
Males Females	• •	• •	4.40 3.68	2.83 2.42	$\frac{4.09}{3.29}$	$\frac{4.39}{3.76}$	3.45 3.43	$6.84 \\ 5.13$	$21.43 \\ 25.97$	6.39 5.76	3.97 3.30
Perso	ONS		4.06	2.62	3.73	4.08	3.44	6.00	22.14	6.14	3.65

Leaving the Territories out of account, Victoria had the most satisfactory and Tasmania the least satisfactory percentage for both sexes.

Number and Proportion above 5 Years of Age Unable to Read.—Commonwealth, 1891-1911.

(a) Number.

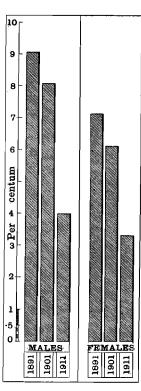


GRAPH No. 44.

The accompanying graphs (Nos. 44 and 45) furnish for the Censuses of 1891 to 1911 a representation of the number of persons of each  $sex \cdot above the age of 5 years who$ were unable to read (No. 44), and of the proportion which this number bore in each case to the total number of such sex and age (No. 45). It will be readily seen from these, that although the actual number unable to read was slightly higher for each sex in 1901 than in 1891, the proportion of illiterates has continually diminished, the fall for the period 1901 to 1911 being very marked.

At each of the Censuses the number and proportion of male illiterates above the age of five years was greater than the corresponding number and proportion of females, the excess being least marked in the case of the Census of 1911.

(b) Proportion.



GRAPH No. 45.

For the Commonwealth as a whole for the last three Censuses the number and proportion of those above the age of 5 years who were unable to read were as follows:—

Number and Proportion above 5 Years of Age Unable to Read.

	M	IALES.		I	Females.		Persons.			
Particulars.	1891.	1901.	1911.	1891.	1901.	1911.	1891.	1901.	1911.	
Number unable to read Proportion per cent. of		141,876	81,092	88,948	96,498	62,140	222,668	238,374	143,232	
Persons aged 5 years and upwards	9.05	8.07	3.97	7.12	6.10	3.30	8.17	7.14	3.65	

The progressive decline at successive Censuses of the proportion above 5 years of age unable to read, furnishes satisfactory evidence of the development of elementary education in Australia.

5. **Education and Age.**—Tabulated in conjunction with age, the data in respect of Education for the Commonwealth as a whole are as follows:—

Education and Age, Commonwealth, 1911.

				AGE L	AST BIRTHDA	Y.		ALL
DEGREE OF EDUCA	TION.		Under 5.	5–9.	10–14.	15–19.	20 and over	Ages.
				MALES.				
English Language— Read and Write				186,650	214,609	225,328	1,302,320	1,928,907
Read only	• • •	• •		1,171	92•	114	5,139	6,516
Foreign Language only— Read and Write				60	172	955	24,692	25,879
Read only			• •	31	11	55	2,471	2,568
Cannot Read			268,073	42,247	1,460	1,877	35,508	349,165
Total			268,073	230,159	216,344	228,329	1,370,130	2,313,03
				FEMALES	•			· ·
English Language—								
Read and Write		• •		185,204	211,620	222,105	1,188,354	1,807,283
Read only		• •		1,159	76	51	7,722	9,008
Foreign Language only— Read and Write				40	99	106	3,929	4,182
Read only	• •	• •	* *	48 8	6	5	488	507
Cannot Read		• •	258,850	37,787	1,069	871	22,413	320,990
Тотат			258,850	224,206	212,870	223,138	1,222,906	2,141,970
				PERSONS.			<u>.</u>	
English Language—			1					
Read and Write				371,854	426,229	447,433	2,490,674	3,736,190
Read only				2,330	168	165	12,861	15,524
Foreign Language only—				•				
Read and Write				108	271	1,061	28,621	30,061
Read only				39	17	60	2,959	3,075
Cannot Read	• •	• •	526,923	80,034	2,529	2,748	57,921	670,155
Total			526,923	454,365	429,214	451,467	2,593,036	4,455,005

Of the population between the ages of 5 and 10, there were 80.034, or about  $17\frac{1}{2}$  per cent. who were unable to read, while between 10 and 15 less than 6 per thousand, and between 15 and 20 almost exactly 6 per thousand could not read. Above age 20 there were 57.921 unable to read, representing about  $2\frac{1}{4}$  per cent. of the total population above 20 years of age.

6. Read and Write, English.—The number and proportion of those of each sex in each State and Territory who could read and write English is given in the following table for the age groups used in this tabulation.

#### Read and Write, English, 1911.

STATE OR TERRITORY.	•			AG	E.				ALL AGES	
	5–9.		10–14.		15–19.		20 and over.		ABOVE 5 YEARS.	
	Num- ber.	Percent- age on total for age group.	Num- ber.	Percentage on total for age group.	Num- ber.	Percent- age on total for age group.	Num- ber.	Percentage on total for age group.	Num- ber.	Percentage on total above 5 years.

#### MALES.

,	- 1		1						-	i I	
STATES—											
New South Wales		67,223	78.77	78,642	99.14	82,564	98.85	483,622	95.34	712,051	83.02
Victoria		55,462	84.27	63,491	99.55	67,732	99.31	373,036	97.01	559,721	85.38
$\mathbf{Queensland}$		27,512	85.61	31,194	98.96	32,322	98.23	179,593	92.03	270,621	82.13
South Australia		15,653	76.33	19,493	99.33	21,381	98.78	116,599	96.02	173,126	83.49
Western Australia		12,128	81.71	11,684	98.87	11,433	96.13	97,759	92.87	133,004	82.32
Tasmania		8,565	75.52	9,955	98.41	9,743	97.61	50,135	93.75	78,398	80.33
TERRITORIES—	į		İ	,		,		·		í l	
Northern		42	44.68	49	75.38	58	73.42	999	41.42	1,148	41.99
Federal	• •	65	72.22	101	100.00	95	98.96	577	93.06	838	84.48
TOTAL		186,650	81.10	214,609	99.20	225,328	98.69	1,302,320	95.05	1,928,907	83.39
			j							l t	

# FEMALES.

		ĺ	•								
STATES—								i l		'	
New South Wa	les	67,392	80.91	77,678	99.38	81,120	99.51	434,376	97.18	660,566	83.72
Victoria		54,871	85.62	62,522	99.71	68,023	99.75	386,154	97.92	571,570	86.61
Queensland		27,163	86.30	30,796	99.18	30,877	99.39	140.113	95.53	228,949	82.86
South Australia	٠	15,423	77.52	19,353	99.47	21,390	99.60	113,208	96.84	169,374	84.18
Western Austra	dia	11,969	82.90	11,573	99.19	10,826	99.44	64,746	97.69	99,114	82.22
Tasmania		8,278	76.42	9,567	98.83	9,725	98.87	49,236	96.37	76,806	82.04
TERRITORIES-	-		.	,		-,		- ,		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Northern		42	47.73	41	68.33	51	69.86	186	69.40	320	55.56
Federal		66	71.74	90	100.00	93	100.00		95.71		80.89
TOTAL		185,204	82.60	211,620	99.41	222.105	99.54	1,188,354	97.17	1,807,283	84.37
	• •			,00		,_		,=:5,002		_,5:.,200	
		ı J			l l						

# PERSONS.

STATES—						- *					•
New South	Wales	 134.615	79.83	156,320	99.26	163,684	99.18	917,998	96.20	1,372,617	83.35
Victoria	• •	 110,333	84.94	126,013	99.63	135,755	99.53	759,190	97.47	1,131,291	85.99
Queensland		 54,675	85.95	61,990	99.07	63,199	98.80	319,706	93.53	499,570	82.46
South Austr	alia	 31,076	76.92	38,846	99.40	42,771	99.19	229,807	96.42	342,500	83.83
Western Au	stralia	 24,097	82.30	23,257	99.02	22,259	97.71	162,505	94.73	232,118	82.28
Tasmania		 16,843	75.96	19,522	98.62	19,468	98.23	99,371	95.03	155,204	81.17
TERRITORIA	es-	,	ľ	,							
Northern		 84	46.15	90	72.00	109	71.71	1,185	44.22	1,468	44.35
$\mathbf{Federal}$		 131	71.98	<b>1</b> 91	100.00	188	99.47	912	94.02	1,422	82.96
TOTAL		 371,854	81.84	426,229	99.30	447,433	99.11	2,490,674	96.05	3,736,190	83.86
								[		- <u> </u>	

Amongst the States, Queensland had the highest proportion able to read and write in the age group 5–9, while Victoria had the highest proportion in all the other groups. At the other extreme, Tasmania had the lowest proportion in the age groups 5–9, and 10–14; Western Australia in the age group 15–19, and Queensland in the age group 20 and over. For the Commonwealth as a whole 96 per cent. of the population aged 20 and over were able to read and write English. In all the States and in all age groups the proportions able to read and write English were higher in the case of females than in that of males.

7. Read only, English.—Particulars in respect of sex and age for those able to "read only" in English are given in the following table:-

·		R	ead only	, Englis	sh, 1911.	_				
				A	Œ.				ALL A	\GES
	5-4	9.	10-14	<b>!.</b>	15–1	9.	20 and	l ove <b>r.</b>	ABOVE 5	YEARS
STATE OR TERRITORY.	Num- ber.	Per 1000 of total for age group.	Num- ber.	Per 1000 of total for age group.	Num- ber.	Per 1000 of total for age group.	Num- ber.	Per 1000 of total for age group.	Num- ber.	Per 1000 of total above 5 years.
		-		MALE	es.					
Queensland South Australia Western Australia Tasmania TERRITORIES Northern	452 166 308 86 80 77	5.30 2.52 9.58 4.19 5.39 6.79	34 9 17 1 15 16	.43 .14 .54 .05 1.27 1.58	48 19 10 5 5 27	.57 .28 .30 .23 .42 2.70	2,116 1,117 835 481 226 353	4.17 2.90 4.28 3.96 2.15 6.60 1.66 11.29	2,650 1,311 1,170 573 326 473	3.09 2.00 3.55 2.76 2.02 4.85
Тотит	1,171	5.09	92	.43	114	.50	5,139	3.75	6,516	9.07
STATES-			F	EMAL	ES.				-	-
New South Wales Victoria Queensland South Australia Western Australia Tasmania TERRITORIES— Northern	431 204 253 144 54 73	5.17 3.18 8.04 7.24 3.74 6.74	30 11 13 5 4 13	.38 .18 .42 .26 .34 1.34	25 7 8 6  5	.31 .10 .26 .28  .51	2,764 2,507 1,033 872 208 333	6.18 6.36 7.04 7.46 3.14 6.52	3,250 2,729 1,307 1,027 266 424	4.12 4.14 4.73 5.10 2.21 4.53
TOTAL	1,159	5.17	76	.36	51	.23	7,722	6.31	9,008	4.21
	-		F	PERSO	vs.	·				
Victoria Queensland South Australia Western Australia	883 370 561 230 134	5.24 2.85 8.82 5.69 4.58 6.76	64 20 30 6 19 29	.41 .16 .48 .15 .81 1.46	73 26 18 11 5 32	.44 .19 .28 .26 .22 1.61	4,880 3,624 1,868 1,353 434 686	5.11 4.65 5.46 5.68 2.53 6.56	5,900 4,040 2,477 1,600 592 897	3.58 3.07 4.09 3.92 2.10 4.69
Federal	2	10.99	•••			••	12 ————————————————————————————————————	1.49 1 <b>2.</b> 37	14	1.21 8.17
Total	2,330	5.13	168	.39	165	.37	12,861	4.96	15,524	3.48

Of the population aged 20 and over about 5 per 1000 were able to read English, but not to write it. Amongst the States this proportion varied between the limits of  $6\frac{1}{2}$  per 1000 for Tasmania and  $2\frac{1}{2}$  per 1000 in the case of Western Australia.

<sup>8.</sup> Read and Write, Foreign.—Of a total of 30,061 at the Census of 1911 who were able to read and write in a foreign language, but not in English, 28,621, or about 95 per cent., were aged 20 years or upwards. Particulars in respect of sex and age are as follows:-

Read and Write, Foreign Language only, 1911.

	THE REPORT OF THE PERSON OF TH			A	GE.				ALL .	Ages
•	5	9.	10-	14.	15–	19.	20 an	d over.	ABOVÉ 5	YEARS
STATE OR TERRITORY.	Num- ber.	Per 1000 of total for age group.	Num- ber.	Per 1000 of total for age group.	Num- ber.	Per 1000 of total for age group.	Num- ber.	Per 1000 of total for age group.	Num- ber.	Per 1000 of total above 5 years.
				MALES.			,			
	1	I .					<del></del>	1		
STATES— New South Wales Victoria Queensland South Australia Western Australia Tasmania FERRITORIES—	1	.08 .03 1.37 .05 .13	35 21 86 5 16	.44 .33 2.73 .25 1.35	239 158 162 101 287	2.86 2.32 4.91 4.67 24.13	6,618 4,018 6,880 1,236 4,850 211	13.05 10.45 35.26 10.18 46.08 3.95	6,899 4,199 .7,172 1,343 5,155 211	8.04 6.40 21.77 6.48 31.91 2.16
Northern Federal	4	42.55	9	138.46		101.27	$\begin{array}{c} 877 \\ 2 \end{array}$	363.60 3.23	898 2	$328.46 \\ 2.02$
TOTAL	60	.26	172	.80	955	4.18	24,692	18.02	25,879	11.19
NT A ID DC		***************************************	FE	MALES.						
STATES— New South Wales Victoria Queensland South Australia Western Australia	1 4 28 3 5	.01 .06 .89 .15	12 9 60 8 7	.15 .14 1.93 .41 .60	23 27 41 2 10	.28 .40 1.32 .09 .92	644 659 1,713 542 310	1.44 1.67 11.68 4.64 4.68	680 699 1,842 555 332	.86 1.06 6.67 2.76 2.75
Tasmania TERRITORIES— Northern	6	68.18		50.00	1 2	.10 27.40	30 31	.59 115.67	32 42	.34 72 92
Federal			••			•••			••	••
TOTAL	48	.21	99	.47	106	.48	3,929	3.21	4,182	1.95
			PE	ERSONS	•				•	
STATES—								Ţ		
New South Wales Victoria Queensland South Australia Western Australia Tasmania	8 6 72 4 7 1	.05 .05 1.13 .10 .24 .05	47 30 146 13 23	.30 .24 2.33 .33 .98	262 185 203 103 297	1.59 1.36 3.17 2.39 13.04	7,262 4,677 8,593 1,778 5,160 241	7.61 6.00 25.14 7.46 30.08 2.30	7,579 4,898 9,014 1,898 5,487 243	4.60 3.72 14.88 4.65 19.45 1.27
ERRITORIES— Northern Federal	10	54.95		96.00		65.79	908 2	338.81 2.06	$^{940}_{2}$	283.99 1.17

Of the total population aged 20 and over, 1.1 per cent. could read and write a foreign language, but not English. The States in which this proportion was heaviest were Western Australia and Queensland. In the former 3 per cent., and in the latter 2.5 per cent. of the population aged 20 and over could read and write a foreign language, but not English. In the other four States the proportions were relatively very small, and ranged between 7.61 per 1000 in the case of New South Wales, and 2.30 per 1000 in that of Tasmania.

9. **Read Only, Foreign.**—The number of persons returned as able to read a foreign language, but not write it, and also unable to read English, was only 3075, or about 7 per 10,000 of population aged five years and upwards. Of these, 2959, or upwards of 96 per cent., were aged 20 years and over. The number and the proportion of the population above the age of 5 years were as follows:—

Read Only, Foreign, 1911.

Paper City and	,		STAT	TERRITO	RIES.				
PARTICULARS.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH.

#### NUMBER.

Males Females			593 64	631	803 262	120 92	365 15	24 4	32	 2,568 507
Person	NS	• •	657	701	1,065	212	380	28	32	 3,075

#### PROPORTION PER 10,000 ABOVE 5 YEARS OF AGE.

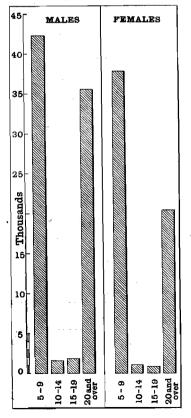
Males Females		••	6.91 .81	9.6 <b>2</b> 1.06	24.37 9.48	5.79 4.57	22.59 1.24	2.46 .43	117.04	 11.10 2.37
Person	NS	••	3.99	5.33	17.58	5.19	13.47	1.46	96.68	 6.90

As in the case of those able to read and write a foreign language only, the proportion in this case was heaviest for Queensland and Western Australia, the order of these two States being, however, reversed.

10. Cannot Read.—The group comprising persons unable to read in any language may conveniently be divided into two sections, one consisting of those under the age of 5 years, concerning whom ability to read could not be expected, and the other, those above that age.

# Number and Proportion of Illiterates in Age-groups above 5.—Commonwealth, 1911.

#### (a) Number.

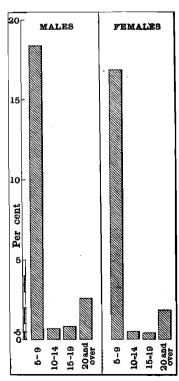


GRAPH No. 46.

In the accompanying graphs (Nos. 46 and 47), a representation is furnished in age-groups of  $_{
m the}$ number of persons of each sex above the age of 5 years who were unable to read at the Census of 1911 (No. 46) and also of the proportion which this number bore in each case to the total population of the same age and sex. These graphs, more particularly No. 47, bring into prominence the fact that above the age of 10 years illiteracy is very rare, and illustrate the comment made in section 1 above concerning the relative unimportance in so far as Australia is concerned of the Census inquiry usually made concerning education.

In all cases the number and proportion of male illiterates exceeded the corresponding number of females.

#### (b) Proportion.



GRAPH No. 47.

At the Census of 1911 the group under five contained 526,923, while the groups of five and upwards contained 143,232 out of a total of 670,155 who could not read; that is to say, about  $78\frac{1}{2}$  per cent. of those unable to read were under the age of 5 years. Particulars as to sex and age for persons unable to read are as follows:—

#### Cannot Read, 1911.

•		Age.									ALL A	Ages.
·	Unde	or 5.	5–9.		10–14.		15-	-19.	20 an	d over.		
STATE OR TERRITORY.	Num- ber	Percentage on total for age group.	Num- ber.	Percentage on total for age group.	Num- ber.	Per- cent- age on total for age group.	ber.	Per- cent- age on total for age group.	Num- ber.	Percentage on total for age group.	Num- ber.	Percentage on total all ages.

#### MALES.

STATES-											[	!	
N.S.W.		102,244	100 00	17 650	20.68	612	.77	659	.79	14,340	2.83	135,505	15.80
Vic				10,172	15.46	254	.40	285	.42		1.49	89,729	13.69
Q'land			100.00			217	.69	406	1.23		3.61	49,740	15.10
S.A			100.00		23.23	125	.64	157	.73	2,998	2.47	32,196	15.53
W.A.	[	17,752	100.00	2,627	17.70	101	.85	144	1.21	2,091	1.99	22,715	14.06
Tas		12,673	100.00	2,698	23.79	144	1.42	212	2.12	2,758	5.16	18,485	18.94
TERRITOR	ES-				1								
N.T.		84	100.00	48	51.06	7	10.77	13	16.46	500	20.73	652	23.85
F.T	• •	85	100.00	. 23	25.56			1	1.04	34	5.48	143	14.42
TOTAL		268,073	100.00	42,247	18.36	1,460	.67	1,877	.82	35,508	2.59	349,165	15.10

# FEMALES.

				1 1	1		1	1	1			ſ	
STATES													
N.S.W.		99,071	100.00	15,470	18.57	442	.57	347	.43	9,146	2.05	124,476	15.78
Vic		70,622	100.00	9,005	14.05	161	.26	134	.20	4,970	1.26	84,892	12.86
Q'land		36,044	100.00	4,030	12.80	176	.57	137	.44	3,560	2.43	43,947	15.91
S.A		23,474	100.00	4,326	21.74	90	.46	77	.36	2,185	1.87	30,152	14.99
W.A.		17,276	100.00	2,410	16.69	84	.72	51	.47	1,001	1.51	20,822	17.27
Tas.		12,179	100.00	2,480	22.90	100	1.03	105	1.07	1,490	2.92	16,354	17.47
TERRITORI	ES-	-		'		ĺ							
N.T.		87	100.00	40	45.45	16	26.67	20	27.40	51	19.03	214	37.15
F.T		97	100.00	26	28.26	• • •	• •	• •		10	2.86	133	18.42
TOTAL		258,850	100.00	37,787	16.85	1,069	.50	871	.39	22,413	1.83	320,990	14.99

#### PERSONS.

-		•		1							Ī		
STATES				l						ĺ			
N.S.W.		201,315	100.00	33,120	19.64	1,054	.67	1,006	.61	23,486	2.46	259,981	15.79
Vic		143,900	100.00	19,177	14.76	415	.33	419	.31	10,710	1.38	174,621	13.27
Q'land		73,848	100.00	8,296	13.04	393	.63	543	.85	10,607	3.10	93,687	15.46
S.A		47,627	100.00	9,089	22.50	215	.55	234	.54	5,183	2.17	<b>62,348</b>	15.26
W.A.		35,028	100.00	5,037	17.20	185	.79	195	.86	3,092	1.80	43,537	15.43
Tas		24,852	100.00	5,178	23.35	244	1.23	317	1.60	4,248	4.06	34,839	18.22
TERRITORII	ES-					•						-	
N.T		171	100.00	88	48.35	23	18.40	33	21.71	551	20.56	866	26.16
<b>F.T.</b>	• •	182	100.00	49	26.92	• •	• •	1	.53	44	4.54	276	16.10
TOTAL .	• •	526,923	100.00	80,034	17.61	2,529	.59	2,748	.61	57,921	2.23	670,155	15.04

Of the population aged 20 and over,  $2\frac{1}{4}$  per cent. were unable to read, while of those between the ages of 10 and 20 the proportion that could not read was only 6 per 1000. Amongst the States, Tasmania had the highest percentage, (4.06) and Victoria the lowest percentage (1.38) of persons aged 20 and over who were unable to read. In practically all cases the proportion of males unable to read was higher than that for females.

11. **Metropolitan Population.**—The following table furnishes particulars in respect of the education of the metropolitan population of the Commonwealth :—

Metropolitan Population, 1911.

							(
DEGREE OF EDUCATION.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total, Metro- politan.
			MALES.		<u>,                                      </u>	<u> </u>	1
English Language— Read and Write Read only Foreign Language only—	259,566 562	240,152 402	57,891 213	76,757 211	44,413 80	15,427 60	694,206 1,528
Read and Write Read only Cannot Read	2,636 197 42,767	1,778 275 35,349	430 64 9,030	$305 \\ 20 \\ 13,285$	695 30 8,013	29 13 2,958	5,873 599 111,402
TOTAL	305,728	277,956	67,628	90,578	53,231	18,487	813,608
		H	EMALES.	1	1	<u> </u>	
English Language— Read and Write Read only	281,355 925	274,824 1,029	62,475 283	85,414 454	45,470 119	18,444 79	767,982 2,889
Foreign Language only— Read and Write	376 33 41,086	$351 \\ 28 \\ 34,783$	245 38 8,811	90 8 13,102	106 7 7,859	6 1 2,920	1,174 115 108,561
TOTAL`	323,775	311,015	71,852	99,068	53,561	21,450	880,721
	I	F	ERSONS.			1	,
English Language— Read and Write Read only	540,921 1,487	514,976 1,431	120,366 496	162,171 665	89,883 199	33,871 139	1,462,188 4,417
Foreign Language only— Read and Write Read only Cannot Read	3,012 230 83,853	2,129 303 70,132	675 102 17,841	395 28 26,387	801 37 15,872	35 14 5,878	7,047 714 219,963
Total	629,503	588,971	139,480	189,646	106,792	39,937	1,694,329

The number and proportion of the metropolitan population above the age of  $\,5\,$  unable to read were as follows:—

Number and Proportion above 5 Years of Age Unable to Read, 1911.

Sex.	Sydney and Suburbs.	and	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total, Metro- politan.
		Ŋ	UMBER.				
Males Females	8,121 7,878		1,420 1,593	3,058 2,948	1,308 1,326	742 789	20,925 $21,153$
Persons	15,999	12,895	3,013	6,006	2,634	1,531	42,078
PRO Males Females	3.00 2.71	2.52 2.34	2.37 2.46	3.81 3.32	VE 5 YEA 2.81 2.82	4.56 4.08	2.89 2.67
Persons	2.85	2.43	2.42	3.55	2.82	4.30	2.77

For the Commonwealth as a whole the proportion per cent. of the population above 5 years of age who were unable to read was 3.65 per cent., as compared with 2.77 per cent. for the metropolitan areas, indicating a higher proportionate degree of illiteracy in the country districts than in the metropolitan areas. For both sexes the proportion of illiteracy was highest in Hobart, while it was lowest for males in Brisbane, and for females in Melbourne.

The proportion which the metropolitan population of each specified degree of education represented of the total population of that degree in the State or Commonwealth is shewn in the following table:—

Proportion per cent. who were Metropolitan Residents, 1911.

DEGREE OF EDUCATION	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	C'wlth
			MALES.	•			
English Language							
Read and Write Read only	$\frac{36.45}{21.21}$	$\frac{42.91}{30.66}$	$\frac{21.39}{18.21}$	$\begin{array}{c} 44.34 \\ 36.82 \end{array}$	33.39 24.54	$\begin{array}{c} 19.68 \\ 12.68 \end{array}$	35.99 23.45
Foreign Language only-							
Read and Write Read only	38.21	42.34	6.00	22.71	13.48	13.74	22.69
Read only	$\frac{33.22}{31.56}$	43.58 39.40	$\begin{array}{c} 7.97 \\ 18.15 \end{array}$	$16.67 \\ 41.26$	8.22 35.28	$\begin{array}{c} 54.17 \\ 16.00 \end{array}$	23.33 $31.91$
-	01.00		10.10	Ŧ1.20	00.20	10.00	01.01
TOTAL	35.65	42.40	20.52	43.68	32.95	18.94	35.17
•			FEMALES	<b>s.</b>		uri - and and are distilled the Vicini	
English Language—					1		
Read and Write	42.59	48.08	27.29	50.43	45.88	24.01	42.49
Read only	28.46	37.71	21.65	44.21	44.74	18.63	32.07
Foreign Language only-							
Read and Write Read only	55.29	50.21	13.30	16.22	31.93	18.75	28.07
Read only	51,56 33,01	40.00 40.97	$14.50 \\ 20.05$	$8.70 \\ 43.45$	46.67 37.74	$25.00 \\ 17.85$	22.68 $33.82$
-			20.00				
Total	41.03	47.13	26.00	49.24	44.43	22.91	41.12
			PERSONS.				
English Language—				1			
Read and Write	39.41	45.52	24.09	47.35	38.72	21.82	39.14
Read only	25.20	35.42	20.02	41.56	33.61	15.50	28.45
oreign Language only-							
Read and Write	39.74	43.47	7.49	20.81	14.60	14.40	23.44
Read only	$35.01 \\ 32.25$	43.22 40.16	9.58 19.04	13.21 $42.32$	9.74 36.46	$50.00 \\ 16.87$	$\frac{23.22}{32.82}$
	02.20	40.10	19.04	42.04	30.40	10.07	34.82
TOTAL	38.23	44.77	23.02	46.42	37.85	20.89	38.03

These figures indicate that whereas 38 per cent. of the total population of the Commonwealth was resident in metropolitan areas, less than  $23\frac{1}{2}$  per cent. of those able to read and write or read only in a foreign language but not in English were so resident. This difference was most marked in the cases of Queensland and Western Australia, and least marked in those of New South Wales and Victoria.

12. **State Sub-divisions.**—Particulars of Education for age and sex are given for State Sub-divisions on pp. 452 to 618 of the Census Detailed Tables, as follows:—New South Wales Counties, pp. 452 to 512; Victorian Counties, pp. 513 to 530; Queensland Census Districts, pp. 531 to 561; South Australian Counties and Divisions, pp. 562 to 582; Western Australian Statistical Districts, pp. 583 to 594; Tasmanian Municipalities, pp. 595 to 614; Northern Territory, pp. 615 to 617; Federal Territory, p. 618.

#### CHAPTER XIV.

# SCHOOLING.

1. Nature and Scope of Inquiry.—The exact form of the inquiry in respect of schooling has already been quoted in the preceding chapter, paragraph I (see p. 166). The particulars asked for differed somewhat from those specified in the Census Schedule, 1901, owing to the omission on the present occasion of any special inquiry concerning "colleges" or "denominational" schools. Experience in the past had shewn that the inquiry concerning colleges led to replies which were unsatisfactory, owing largely to the miscellaneous nature of the educational establishments to which the term was applied, varying, as they did, from infant schools at the one extreme, to colleges affiliated with universities at the other. The classification under the heading "denominational" had also in the past proved difficult and unsatisfactory, and was consequently also abandoned on the present occasion. There remained then four heads concerning which particulars were required, the instruction being that U should be inserted on the personal card of each person who at the date of the Census was a student at a University, S if at a State School, and P if at any other school, while H was to be inserted if education was being received at home.

It should be noted that throughout this chapter the term "State School" comprises all schools, whether primary or secondary, which are under the direct control of the State.

- 2. General View of Results.—Notwithstanding the increased simplicity of the inquiry, a large number failed to give an explicit reply, no fewer than 21,572 furnishing a statement that they were "scholars" without indicating the class of school at which they were receiving education. For the purposes of this chapter the number of these at each age has been distributed proportionately over the groups "State School," "Private School," and "Home," the distribution being effected separately for each sex. In addition a large number, amounting to no fewer than 64,426 of those recorded as between the ages of 6 and 13 years, furnished no indication that they were in receipt of education. To what extent these children were evading the provisions of the Education Acts, or were beyond the reach of educational facilities, it is impossible to say. This question is further discussed in paragraphs 7 and 8 of this chapter (pp. 186 and 188), where comparisons with the enrolments of the several States for 1910 and 1911 are furnished. Of a total of 700,111 actually recorded as between the ages of 6 and 13, there were 496,163, or nearly 71 per cent., returned as attending State schools; 106,663, or rather more than 15 per cent., as attending private schools; 17,151, or about 2½ per cent., as being educated at home; 15,708, or about 2½ per cent., returned simply as "scholar"; while 64,426, or about 9¼ per cent., furnished no indication as to receipt of education.
- 3. Aggregates for States.—After the distribution referred to in the preceding paragraph of those recorded simply as "Scholar," the totals for the several States and the Commonwealth were as shewn in the succeeding table. In this table the column headed "Number not indicated as receiving education" comprises persons beyond school age as well as those of school age concerning whom no such indication was furnished.

# Schooling as at 3rd April, 1911.

· 	Nuмв	er Receivin	Number not indicated			
STATE OR TERRITORY.	State School.	Private School.	Home.	Uni- versity.	as re- ceiving education.	TOTAL.
		MALES.				
STATES						
New South Wales	110,704	27,913	4,782	762	713,537	857,698
Victoria	92,547	23,333	1,852	820	537,039	655,591
Queensland	45,633	7,912	1,991	34	273,936	329,506
South Australia	25,548	5,378	711	271	175,450	207,358
Western Australia	18,639	4,618	770	7	137,531	161,565
Tasmania	13,116	2,985	616	32	80,842	97,591
TERRITORIES—						
Northern	37	33	11		2,653	2,734
Federal	120		25	• •	847	992
Total	306,344	72,172	10,758	1,926	1,921,835	2,313,035

#### Schooling as at 3rd April, 1911-continued.

	Numbe	R RECEIVIN	Number not indicated	<b>T</b>		
STATE OR TERRITORY.	State School.	Private School.	Home.	Uni- versity:	as receiving education.	TOTAL.

#### FEMALES.

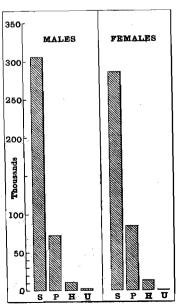
STATES—       102,049         New South Wales       102,049         Victoria       86,853         Queensland       43,310         South Australia       24,994         Western Australia       16,978         Tasmania       12,388         TERRITORIES—	33,841 25,259 10,152 5,500 5,652 3,503	5,733 2,348 2,278 907 929 784	171 204 22 116 7	647,242 545,296 220,545 169,683 96,983 76,926	789,036 659,960 276,307 201,200 120,549 93,620
I deliquized	3,503	784	19 :	76,926	93,020
Northern 37	24	7 16		508 597	576 722
TOTAL	83,934	13,002	539	1,757,780	2,141,970

#### PERSONS.

TOTAL	 	593,059	156,106	23,760	2,465	3,679,615	4,455,005
Federal	 • •	226	3	41	• •	1,444	1,719
Northern	 	74	57	18	• •	3,161 1,444	3,310 1,714
TERRITORIES-	į					0.141	0.016
Tasmania	 	25,504	6,488	1,400	51	157,768	191,211
Western Australia	 	35,617	10,270	1,699	14	234,514	282,114
South Australia	 	50,542	10,878	1,618	387	345,133	408,558
Queensland	 	88,943	18,064	4,269	56	494,481	605,813
Victoria	 	179,400	48,592	4,200	1,024	1,082,335	1,315,551
STATES— New South Wales	 	212,753	61,754	10,515	933	1,360,779	1,646,734

The smallness of the numbers receiving education at Universities in Queensland and Western Australia is due to the fact that the Universities in these States have only recently

# Schooling as at 3rd April, 1911 (Commonwealth).



GRAPH No. 48.

been opened, that in Queensland in March, 1911, and that in Western Australia in March, 1913. The number in the case of Western Australia consequently represented students who were away from the Universities at which they were being educated. It will be seen that in all the States the number of males who were students at State Schools and Universities exceeded the number of females, but that in the cases of private school pupils and persons educated "at home," there was in all cases an excess of females.

The accompanying Graph (No. 48) furnishes, for the Commonwealth as a whole, a representation of the number of students of all ages, the sexes being shewn separately. The letter S denotes "State School," the letter P, "Private School," the letter H indicates education "at home," while the letter U denotes "University."

4. Proportionate Distribution of those Receiving Education.—In the following table is shewn for each sex and for the sexes combined the proportion of those receiving education who were receiving it at each of the classes of institution specified.

Proportion per cent. at each Class of Institution, Commonwealth, 1911.

_					Рворе	DRTION PER EDUCATION		IAING	
STATE (	or Ter	RITORY	7.		State School.	Private School.	Home.	Uni- versity.	TOTAL
•					MALES.				•
STATES									
New South Wales					76.79	19.36	3.32	.53	100.00
Victoria					78.07	19.68	1.56	.69	100.00
Queensland					82.12	14.24	3.58	.06	100.00
South Australia			• •		80.07	16.85	2.23	.85	10 '.00
Western Australia			• •		77.55	19.22	3.20	.03	10 .00
Tasmania		• • •	• •		78.31	17.82	3.68	.19	100.00
TERRITORIES—	• •	• •	• •	• •	10.01	11.02	<b>J.</b> 00	.10	100.00
Northern					45.68	40.74	13.58		100.00
Federal		• •			82.76	10.11	17. 4		100.00
	• •	• •	••	• •	02.10		<u> </u>		
Commonwealth					78.31	18.45	2.75	.49	100.00
STATES— New South Wales Victoria Queensland South Australia Western Australia					71.97 75.74 77.67 79.30 72.05	23.87 22.03 18.21 17.45 23.98	4.04 2.05 4.08 2.88 3.94	.12 .18 .04 .37	100.00 100.00 100.00 100.00
Tasmania					74.21	20.98	4.70	.11	100.00
ERRITORIES									
Northern					54.41	35.29	10.30		100.00
Federal .					84.80	2,40	12.80		100.00
Commonwealth	,				74.63	21.85	3.38	.14	100.00
			-		PERSONS	•	L		
						7.4.			
TATES—							1	J.	
				!	74.40	21.59	3.68	.33	100.00
TATES— New South Wales Victoria				::	74.40 76.92	$21.59 \\ 20.84$	3.68 1.80	.33 .44	
New South Wales Victoria					76.92				100.00
New South Wales Victoria Queensland	••	• •	••		76.92 79.89	20.84 16.23	1.80 3.83	.44 .05	100.00 100.00 100.00 100.00
New South Wales Victoria Queensland South Australia	•••	•••	• •		76.92 79.89 79.69	20.84 16.23 17.15	1.80 3.83 2.55	.44 .05 .61	100.00 100.00 100.00
New South Wales Victoria Queensland South Australia Western Australia	•••	••	•••	••	76.92 79.89 79.69 74.82	20.84 16.23 17.15 21.58	1.80 3.83 2.55 3.57	.44 .05 .61 .03	100.00 100.00 100.00 100.00
New South Wales Victoria Queensland South Australia Western Australia Tasmania	•••	•••	• •		76.92 79.89 79.69	20.84 16.23 17.15	1.80 3.83 2.55	.44 .05 .61	100.00 100.00 100.00
New South Wales Victoria Queensland South Australia Western Australia Tasmania ERRITORIES—	•••	••		••	76.92 79.89 79.69 74.82 76.26	20.84 16.23 17.15 21.58 19.40	1.80 3.83 2.55 3.57 4.19	.44 .05 .61 .03	100.00 100.00 100.00 100.00 100.00
Victoria Queensland South Australia Western Australia Tasmania ERRITORIES Northern	•••			• • • • • • • • • • • • • • • • • • • •	76.92 79.89 79.69 74.82 76.26	20.84 16.23 17.15 21.58 19.40	1.80 3.83 2.55 3.57 4.19	.44 .05 .61 .03 .15	100.00 100.00 100.00 100.00 100.00
New South Wales Victoria Queensland South Australia Western Australia Tasmania EERRITORIES—	•••	••		••	76.92 79.89 79.69 74.82 76.26	20.84 16.23 17.15 21.58 19.40	1.80 3.83 2.55 3.57 4.19	.44 .05 .61 .03	100.00 100.00 100.00 100.00

Of persons of both sexes recorded as receiving education at the date of the Census, the proportion being educated at State schools varied amongst the States between the limits of 74.40 per cent. in the case of New South Wales, and 79.89 per cent. in the case of Queensland. On the other hand, with regard to Private Schools, the same two States furnished the limiting proportions, but Queensland, with 16.23 per cent., furnished the lower, and New South Wales, with 21.59 per cent., the higher limit. Amongst the States Tasmania furnished the highest proportion being educated "at home," and South Australia the highest at a University, the lowest proportions in these cases being furnished respectively by Victoria and Western Australia. In all cases amongst the States the proportion at State schools and Universities was higher for males than for females, while in all cases the proportion for those educated in private schools and at home was lower for males than for females.

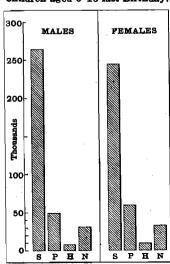
5. Compulsory School Age.—As already noted in Chapter X., Ages, the compulsory school age for the States of New South Wales, Victoria, Western Australia, and Tasmania is now, and was at the date of the Census, from 6 to 13 last birthday inclusive. The same range is also now in operation in Queensland, although at the date of the Census the period was only 6 to 11 inclusive. In South Australia the period is now, and was at the date of the Census, 7 to 13 inclusive. The period from 6 to 13 may thus in a general way be regarded as the Australian compulsory school age. Tabulated according to the place of education, the particulars in respect of children of this period of age in each of the States and Territories are as shewn in the succeeding table, in which allowance has been made for the number of children of unspecified age.

Children Aged last Birthday from 6 to 13 Years, 1911.

•				Number re	CEIVING EDUC	ATION AT-	Number not indicated	Total aged 6 to	
STATE OR TEE	RRITORY	•		State School.	Private School.	Home.	as re- ceiving education.	13 last birthday.	
				MA	LES.				
STATES—	,								
New South Wales				95,225	19,804	3,566	11,618	130,213	
Victoria .		• •		79,947	15,716	1,227	6,022	102,912	
Queensland				39,018	5,298	1,551	5,101	50,968	
South Australia			• • •	23,182	3,609	532	4,408	31,73	
Western Australia			· ·	15,734	3,330	574	1,661	21,29	
Tasmania		• •		11,466	2,197	476	2,843	16.98	
TERRITORIES	• •	• •	• •	11,400	2,101	110	2,010	10,00	
37 41 .				32	26	10	55	123	
Nortnern Federal		• •	• •	101		23	27	15	
rederal	• • •	• •	• •	101					
Total	• •	• •	• •	264,705	49,980	7,959	31,735	354,379	
		_		FE	MALES.	`		-	
STATES—									
New South Wales				86,761	24,074	4.328	12,837	128,000	
Victoria	• • •	• •		74,804	17.843	1,639	6.514	100,800	
Queensland	• •			36,536	6,935	1,756	4.788	50,01	
South Australia	• • •	• •		22,018	4.132	650	4,305	31,10	
Western Australia			• •	14,229	4,146	696	1,822	20,89	
		• •	• •	10,661	2,591	616	2,513	16,38	
Tasmania FERRITORIES—	• •		• •	10,001	2,001	010	2,010	10,00	
				90	20	6	69	12	
Northern	• •	• •	• •	$\begin{array}{c} 32 \\ 92 \end{array}$	3	13	26	13	
Federal	• • .	• •	. ••	92	3	13	20	134	
Total			• •	245,133	59,744	9,704	32,874	347,45	
				PE	RSONS.	,			
	·		-		.				
STATES— New South Wales				101 000	49.079	7,894	24,455	258,213	
		• •	• •	181,986	43,878	2,866	12,536	203,713	
Victoria	• •	• •	• •	154,751	33,559			100,983	
Queensland	• •	• •	• •	75,554	12,233	3,307	9,889	62,836	
South Australia	• •	• •	• •	45,200	7,741	1,182	8,713		
Western Australia	• •	• •	• •	29,963	7,476	1,270	3,483	42,193	
Tasmania	• •	• •	• •	22,127	4,788	1,092	5,356	33,363	
TERRITORIES—							1	2-	
Northern	• •			64	46	16	124	250	
Federal	• •	• •	• •	193	3	36	53	28	
Total				509,838	109,724	17,663	64,609	701,834	

For the Commonwealth, as a whole, the number of males of school age attending State schools exceeded the number of females, while the number of females was in excess in the

Children aged 6-13 last Birthday.



GRAPH No. 49.

cases of persons being educated at private schools or at home, or concerning whom no indication was given. Similar excesses were in evidence in each of the States, except for those not indicated as receiving education in Queensland, South Australia, and Tasmania, in which the males exceeded the females.

A representation, for the Commonwealth as a whole, of the number of children of school age, that is, aged from 6 to 13 last birthday, is furnished in the accompanying graph (No. 49), distinction being made between males and females. In this graph, the letter S denotes State School Pupils, the letter P Private School Pupils, the letter H those being educated at home, while the letter N denotes those concerning whom no indication as to education was furnished.

The following table shews the proportion of children of school age in each State and Territory receiving education at each of the specified places of instruction.

Proportion of Children of Compulsory School Age at each Class of Institution, etc., 1911.

Sm. mv T	<b>.</b>	·				TON PER CENT		Proportion per cent. not in-	Total.
STATE OR T	ERRITO	RY.			State School.	Private School.	Home.	dicated as receiving education.	TOTAL
				M	ALES.				
STATES—				1					
New South Wales					73.13	15.21	2.74	8.92	100.00
Victoria					77.69	15.27	1.19	5.85	100.00
${f Queensland}$					76.55	10.40	3.04	10.01	100.00
South Australia					73.06	11.37	1.68	13.89	100.00
Western Australia					73.87	15.63	2.70	7.80	100.00
Tasmania					67.52	12.94	2.80	16.74	100.00
FERRITORIES					0.7.0_		,		
Northern					26.02	21.14	8.13	44.71	100.00
Federal	• •				66.89		15.23	17.88	100.00
Commonwealth					74.70	14.10	2.25	8.95	100.00
				<b>F</b>	EMALES.			1	
TATES—								[	
New South Wales					67.78	18.81	3.38	10.03	100.00
Victoria					74.21	17.70	1.63	6.46	100.00
Queensland					73.05	13.87	3.51	9:57	100.00
South Australia					70.79	13.28	2.09	13.84	100.00
Western Australia					68.11	19.84	3.33	8.72	100.00
Tasmania			• • •		65.08	15.82	3.76	15.34	100.00
TERRITORIES—	• •		• •		30.00	10.02	0	1	
Northern					25.20	15.75	4.72	54.33	100.00
Federal					68.66	2.24	9.70	19.40	100.00
Commonwealth					70.55	17.20	2.79	9.46	100.00
· ·				P	ERSONS.				
TATES—		-					2.00		****
New South Wales	• •	• •			70.48	16.99	3.06	9.47	100.00
Victoria					75.97	16.47	1.41	6.15	100.00
Queensland					74.82	12.11	3.28	9.79	100.00
South Australia	• •				71.93	12.32	1.88	13.87	100.00
Western Australia					71.02	17.72	3.01	8.25	100.00
Tasmania ERRITORIES—	• •	• •			66.32	14.35	3.27	16.06	100.00
3.7				1	95.00	10.40	0.40	40.60	100.00
	• •	• •	• •		25.60	18.40	6.40	49.60	
Federal	• •	• •	• •		67.72	1.05	12.63	18.60	100.00
Commonwealth					72.64	15.63	2.52	9.21	100.00

Amongst the States, Victoria had the highest proportion of children of compulsory school age who were attending State schools, and the lowest proportion being educated at home, and not indicated as receiving education. Tasmania had the lowest proportion being educated at State schools, and the highest proportion not indicated as receiving education, while Queensland had the lowest proportion being educated at private schools, and the highest at home. Western Australia had the highest proportion at private schools.

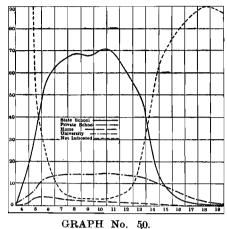
6. Commonwealth Details for Successive Ages.—The number of children receiving education at the date of the Census at each of the specified places of instruction was as follows:—

Schooling of Commonwealth Population (sexes combined) 1911.

			Number receiving education at-						Number not indicated	
A	GE LAS	r birt	HDAY.		State School.	Private School.	Home.	Uni- versity.	as re- ceiving education.	Total.
Under 5					9,307	2,934	330		514,352	526,923
5					33,421	7,298	3,308		52,225	96,252
6					58,347	12,474	3,903		19,689	94,413
7					64,876	13,880	2,961		6,451	88,168
8					68,637	14,079	2,382		3,706	88,804
9					67,472	13,908	2,206		3,142	86,728
10					69,977	14,380	1,883		3,036	89,276
11					68,896	14,419	1,674		4,038	89,027
12					60,679	13,495	1,402		6,243	81,819
13					50,954	13,089	1.252		18,304	83,599
1 <b>4</b>					24,418	10,980	891		49,204	85,493
15					8,749	8,489	573		69,892	87,703
16					3,311	6,342	331	73	78,912	88,969
17					1,592	3,698	210	146	85,435	91,081
18					950	2,173	145	333	89,760	93,361
19					685	1,253	90	364	87,961	90,353
20 and ov	e <b>r</b>	·	• •	• •	788	3,215	219	1,549	2,587,265	2,593,036
Тотаг		••	•••	••	593,059	156,106	23,760	2,465	3,679,615	4,455,005

The number attending State schools attained a maximum at age 10, private schools at age 11, and "at home" at age 6, while the number not indicated as receiving education attained a minimum at age 10.

## Schooling and Age (Sexes combined), Commonwealth, 1911.



In the accompanying graph (No. 50) is represented the distribution according to age of the several classes of pupils for the Commonwealth as a whole. The base of each small rectangle represents a year of age, and the vertical height represents 10,000 scholars. In this graph the curves relate to the sexes combined. The figures for university students at ages under 20 are so small relatively as to fail to appear. Features of special interest in this graph are (i.) the rapid rise in the State School curve to age 6, and the rapid fall from age 11; (ii.) the complementary rapid fall and rise in the curve for children whose schooling was "not indicated"; (iii.) the slightness of the variation in the Private school curve from age 6 to age 13; and (iv.) the steady fall in the "Home" curve from age 6.

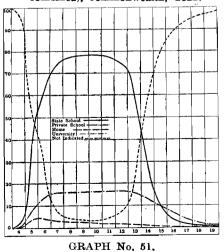
The proportion per cent. of the Commonwealth population at each age specified who were receiving education at each of the places of instruction was as follows:—

Commonwealth Population (sexes combined), 1911.—Proportion per cent. at each Class of Institution, etc.

					Рвор	ORTION PER EDUCA	Proportion per cent.	_		
	Agi	E LAS	r birti	IDAY.	State School.	Private School.	Home.	Uni- versity.	dicated as receiving education.	Total.
Under	5				 1.77	.56	.06		97.61	100.00
5					 34.72	7.58	3.44		54.26	100.00
6					 61.80	13.21	4.13		20.86	100.00
7					 73.58	15.74	3.36		7.32	100.00
8 9					 77.29	15.86	2.68		4.17	100.00
9					 77.80	16.04	2.54		3.62	100.00
10					 78.38	16.11	2.11	l	3.40	100.00
11					 77.39	16.20	1.88		4.53	100.00
12					 74.16	16.50	1.71		7.63	100.00
13					 60.95	15.66	1.50	l	21.89	100.00
14					 28.56	12.84	1.04	l . <b>.</b>	57.56	100.00
15					 9.98	9.68	.65		79.69	100.00
16					 3.72	7.13	.37	.08	88.70	100.00
17					 1.75	4.06	.23	.16	93.80	100.00
18					 1.02	2.33	.15	.36	96.14	100.00
19					 .76	1.39	.10	.40	97.35	100.00
20 and	l over	• • •	• •		 .03	.12	.01	.06	99.78	100.00
Co	OMMON	WEAL	тн		 13.31	3.50	.53	.06	82.60	100.00

The maximum percentage at any age attending State schools was 78.38 per cent. at age 10, while the maximum for private schools was 16.50 per cent. at age 12. For those being educated "at home" the maximum percentage was

Proportionate Distribution (Sexes combined), Commonwealth, 1911.



educated "at home" the maximum percentage was 4.13 per cent. at age 6, while the minimum percentage in the case of those not indicated as receiving instruction, was 3.40 at age 10.

In graph No. 51, a representation is given of the proportion per cent. of the population (sexes combined) at each age receiving instruction at the several classes of institution indicated. The base of each small rectangle represents a year of age and the vertical height 10 per cent. The features noted in connection with graph 50 representing the numbers at each age, are equally striking in the present graph, representing the proportions at each age.

The relative numbers of males and females at each age receiving education at each class of institution will be seen from the following table, which gives under each head the excess of males over females per 100 of the sexes combined.

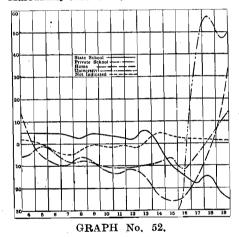
# Commonwealth Population, 1911, Masculinity of Scholars. (Excess of Males over Females per 100 of sexes combined.)

				Mas	CULINITY O	1100 111	Masculinity		
A	GE LAS	BIRTE	IDAY.	State School.	Private School.	Home.	Uni- versity.	dicated as receiving education.	of total population
Under 5				 5.10	4.98	6.06		1.73	1.75
5 5				 4.98	- 1.64	- 5.68		.10	1.46
6	• •			 4.81	- 3.82	- 8.28		3.01	1.50
7	• •			 4.07	8.03	9.42		4.67	1.08
é	• • •	• •		 3.11	- 8.13	6.55		2.97	.82
8	• •	• • •		 4.20	- 8.46	8.07			1.68
10	• •	• •		 3.69	-10.63	12.27		1.25	.88
11			• •	 3.45	-11.16	13.14		1.09	.57
12				 2.35	-10.47	11.98		1.62	31
13				 5.44	9.95	15.18		.39	1.61
14				 .03	- 9.34	23.23	1	4.74	1.28
15				 - 9.38	- 6.66	25.65		2.58	.30
16				 13.86	-11.01	23.87	17.81	2.62	.92
17		• •		 17.46	5.80	-14.29	39.73	1.76	1.16
18				 15.58	2.16	3.45	55.56	1.96	1.97
19				 23.50	10.61	17.78	48.35	1.20	1.35
20 and or		• •		 -26.40	17.82	55.25	63.33	5.63	5.68
ALL	Ages			 3.31	- 7.53	9.44	56.27	4.46	3.84

Note, - denotes excess of females.

This table clearly indicates the preponderance at State schools of male scholars under the ages of 14, and the similar preponderance of male University students above the age of 16. On the other hand, at practically all ages a preponderance is shewn of females receiving education There is also a preponderance of females amongst those at private schools and "at home." not indicated as receiving education for all ages from 6 to 12 inclusive.

Masculinity of Scholars, Commonwealth, 1911.



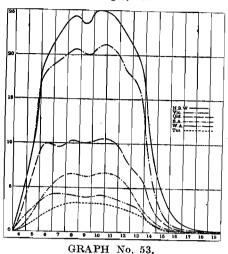
Graph No. 52 furnishes a representation of the masculinity of the scholars attending each class of school, the curves given relating to the Commonwealth as a whole. As here used the term masculinity denotes the excess of males over females per 100 of the sexes combined. The zero line in the graph consequently indicates equality of the sexes, while a position above this line indicates excess of males, and a position below The base of each small rectangle it excess of females. represents a year of age, and the height a masculinity of The leading features of this graph are: (i.) the preponderance of males in the State school curve to age 13, and of females thereafter; (ii.) the preponderance of females in Private schools at practically all ages; (iii.) the preponderance of females amongst those educated at home at nearly all ages.

7. State School Pupils.—The number of children in each year of age attending State schools in each State and Territory at the date of the Census was as follows:

Attending State Schools (sexes combined), 1911. TERRITORIES. STATES. C'wlth. AGE LAST N.T. F.T. Tas. BIRTHDAY. W.A. Q'land. S.A. N.S.W. Vic. 9,307 1,039 293 1.588 2.900 3,152 Under 5 33,421 6,547 9,742 9,677 1.147 10,530 2,041 2,576 10,572 4,423 3,887 20 58,347 19,927 18,228 2,831 3,216 10 8 23 64,876 5,975 4,18819,465 20,484 22,707  $\begin{array}{c} 7 \\ 8 \\ 9 \end{array}$ 23 68,637 4,105 3,908 6,481 6,279 24,145 10,175 23,813 24,920 24,412 22,242 3,165 10 30 67.472 10,122 10,404 20,145 69,977 29 20,143 20,851 20,734 10 6,549 4,031 3,183 10 <del>68</del>,896 3,871 3,310 3,009 6 9 7 5 10,301 6,548 11 5,595 3,350 2,570 28 60,679 18,427 16,417 7,232 8,498 6,635  $\frac{25}{25}$ 50,954 2,663 2.037 19,820 13 1,172 1,190 9,960 1,659 14 8,749 3,311 6 3 2 1,224 402 15 4,050 2,064 585 1 290 178 193 1,555 685 689 16 1,592 87 178 74 17 ٠. 43 950 119 51 361 257 119 1 1 685 29 230 180 788 38 60 47 454 20 and over 74 226 593,059 35,617 25,504 50.542 212,753 179,400 88.943 TOTAL

The maximum number at any age was attained at age 10 for the Commonwealth as a whole, and in New South Wales, Victoria, Queensland and South Australia; at age 7 in Western Australia; and at age 8 in Tasmania. The average

Number of State School Pupils, States and Ages, 1911.



tralia; and at age 8 in Tasmania. The average ages of the State school pupils in the Commonwealth and its several States and Territories were as follows:—Commonwealth, 9.46 years; New South Wales, 9.63; Victoria, 9.41; Queensland, 9.23; South Australia, 9.52; Western Australia, 9.13; Tasmania, 9.59; Northern Territory, 9.91; Federal Territory, 10.09.

Graph No. 53 represents the number of State School pupils at each age in each of the States of the Commonwealth. The base of each small rectangle represents a year of age, and the height represents 5000 scholars. The dip seen in the several curves at age 9 is not peculiar to those relating to State school pupils, but is common to all the Australian curves for juvenile ages for the 1911 census.

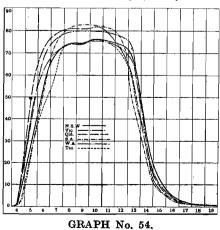
The proportion per cent. of the total children at each age who were attending State schools is shewn in the succeeding table.

Proportion per cent. attending State Schools (sexes combined).

	E LAST				STAT	ES.			TERRIT	ORIES.	
вп	RTHDAY.	•	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH  55 1.77 12.50 34.72 57.14 61.80 62.16 73.58 92.00 77.29 74.36 78.38 53.57 77.39 68.29 74.16 71.43 60.95 31.25 28.56 16.22 9.98 9.09 3.72
Under 5			1.44	2.19	2.15	.70	2.97	1.18			177
5			28.89	38.95	50.61	23.81	40.16	24.84	8.11		
6			56.28	68.81	73.01	52.87	63.22	46.12	12.12		
7			70.23	76.89	79.00	75.53	71.05	64.53	$\begin{array}{c} 12.12 \\ 22.73 \end{array}$		
8			74.24	79.41	81.00	81.50	73.65	74.15	22.86		
9			74.94	79.75	80.85	82.60	74.44	74.59	30.30		
10			76.07	79.70	81.47	82.20	75.29	75.93	32.26		
11			75.46	79.08	78.50	81.12	74.77	74.65	24.00		
12			73.59	77.44	70.88	75.41	71.66	69.50	31.03		
13			64.28	66.54	53.40	44.39	63.77	52.41	35.00		
14			31.81	28.22	25.97	20.55	28.61	29.39	25.00		
15		٠.	12.63	7.80	9.64	7.06	10.17	10.05	20.00		
16			4.82	2.54	3.21	3.36	4.12	4.82	4.35		
17			2.05	1.40	1.42	2.06	1.59	2.19		4.35	1.75
18			1.06	.91	.90	1.36	1.06	1.03	· ::		1.02
19			.69	.66	.64	1.01	1.58	.76	3.23	3.23	.76
0 and ov	ær		.05	.02	.02	.02	.02	.02			03
ALL A	AGES		12.92	13.64	14.68	12.37	12.63	13.34	2.24	13.19	/ 13.31

Amongst the States the highest proportion attending State schools was furnished by Western Australia for ages under 5; by Queensland for ages 5, 6 and 7; by South Australia for ages 8,

Proportion of State School Pupils, States and Ages, 1911,



9, 10, and 11; by Victoria for ages 12 and 13; and by New South Wales for ages 14 and 15.

In Graph No. 54 a representation is given for each of the States of the proportion per cent. of State school pupils amongst the persons at each age. The base of each small rectangle represents a year of age and the height 10 per cent. It will be seen that although there is a similarity in the general trend of the curves, there are marked divergences, the most striking being the case of Tasmania on the one hand and Queensland on the other.

The relative numbers of males and females of each age attending State schools is shewn in the next table, which gives under each head the excess of males over females per 100 of the excess combined.

Masculinity of State School Pupils (Excess of Males over Females per 100 of the sexes combined), 1911.

Agı	LAST	1 1		STA	res.			Terri	rories.	
BIRT	HDAY.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth.
Under 5		 5.72	5.46	2.27	5.39	10.30	3.75		100.00	5.10
5		 3.22	6.02	4.66	5.14	8.23	6.36		60.00	4.98
6		 5.47	4.28	3.76	5.00	4.45	8.22			
7 8 9		 5.14	3.96	2.72	2.90	6.06	.32			4.07
8		 2.50	3.30	3.31	3.38	4.80	3.42	.00	- 21.74	3.11
		 5.16	3.86	1.82	4.70	6.35	3.25	20.00	<b>—</b> 13.33	4.20
10		 4.16	3.33	3.98	1.57	4.59	4.68	20.00	N.T. F.T.  100.00 5.10 - 33.33 — 60.00 4.98 - 50.00 10.00 4.81 .00 21.74 4.07 .00 — 21.74 3.11 20.00 — 13.33 4.20 20.00 — 17.24 3.69 33.33 20.00 3.45 11.11 21.43 2.35 - 71.43 28.00 5.44 60.00 46.67 — .03 33.33 — 9.38 - 100.00 — 33.33 — 9.3800 — 17.46 — 15.58	
11		 4.65	2.67	2.92	2.23	3.75	3.09	33.33	20.00	3.45
12		 2.58	1.16	3.60	1.20	3.56	5.45	11.11	21.43	2.35
13		 8.21	4.12	4.69	<b>—</b> 1.79	6.95	1.33	<b>→</b> 71.43	28.00	5.44
14		 4.24	.33	<b></b> 4.36	-15.73	1.18	4.27	60.00	46.67	<b>.03</b>
15		 4.64	8.72	17.48	22.39	12.44	14.51		33.33	→ 9.38
16		 - 9.58	- 11.76	14.93	-33.10	17.98	20.21	100.00	33.33	13.86
17		 , 12.41	14.88	23.50	-42.70	10.81	10.34		.00	17.46
18		 21.33	10.51	<b>—17.65</b>	56.30	13.73	39.53		١	15.58
19		 18.26	10.00	40.74	55.06	35.14	31.03	100.00	100.00	<b> 23.50</b>
20 and ov	er	 43.17	18.52	16.67	36.17	94.74	3.70			26.40
ALL AG	es	 4.07	3.17	2.61	1.10	4.66	2.85	.00	6.19	3.31

Note, — denotes excess of females.

This table indicates a predominance in males amongst State school pupils to age 14 inclusive in New South Wales and Victoria, to age 13 inclusive in Queensland, Western Australia and Tasmania, and from age 5 to age 12 inclusive in South Australia. The masculinity varies irregularly with age in the several States, and for the principal ages is higher for Western Australia than for any other State.

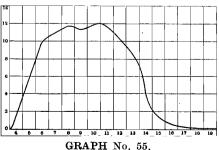
The age distribution per cent. of the State school pupils in each of the States and Territories was as follows:—

Age Distribution per cent. of State School Pupils, 1911.

Age	LAST				STAT	ES.	,		TERRIT	ORIES.	
BIRT	THDAY.		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	.44 1.57 2.21 5.64 8.85 9.84 10.18 10.94 10.18 11.57 13.27 11.38 12.83 11.80 6.64 11.62 12.39 10.23 11.06 8.59 6.64 4.12 2.65 1.47
Under 5			1.36	1.76	1.79	.66	2.92	1.15		.44	1.57
5			4.97	5.87	7.36	4.04	7.23	4.50	4.06	2.21	
6			9.37	10.16	10.95	8.75	10.91	8.30	5.41	8.85	9.84
7 8 9 10			10.67	10.85	10.88	11.82	11.76	11.10	13.51	10.18	10.94
8			11.35	11.42	11.44	12.82	11.52	12.61	10.81	10.18	
9			11.19	11.23	11.38	12.42	10.97	12.41	13.51	13.27	
10			11.71	11.62	11.70	12.96	11.32	12.48	13.51	12.83	11.80
11			11.48	11.56	11.58	12.96	10.87	11.80	8.11	6.64	
12			10.46	10.27	9.55	11.07	9.29	10.08	12.16	12.39	10.23
13			9.32	9.15	7.46	6.63	7.48	7.99	9.46	11.06	8.59
14			4.68	4 03	3.58	3.28	3.34	4.59	6.76	6.64	4.12
15			1.90	1.15	1.38	1.16	1.22	1.51		2.65	1.47
16			.73	.39	.45	.57	.50	.76	1.35	1.33	.56
17			.32	.21	.21	.35	.21	.34		.89	.27
18			.17	.14	.13	.24	.14	.17			.16
19			.11	.10	.09	.18	.21	.11	1.35	.44	.11
20 and ov	er	• •	.21	.09	.07	.09	.11	.10		••	.13
ALL A	GES		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Of the total number of State school pupils in the Commonwealth, 85.97 per cent. were aged from 6 to 13 last birthday, the corresponding proportion for the several States and Territories being as follows:—New South Wales, 85.55 per cent.; Victoria, 86.26 per cent.; Queensland, 84.94 per cent.; South Australia, 89.43 per cent.; Western Australia, 84.12 per cent.; Tasmania, 84.12 per cent.; Tasmania, 84.12 per cent.; Tasmania, 84.12 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania, 85.55 per cent.; Tasmania

Proportionate Age Distribution of State School Pupils, Commonwealth, 1911.



86.77 per cent.; Northern Territory, 86.48 per cent.; and Federal Territory, 85.40 per cent.

In Graph No. 54 there was given for each of the States a representation of the proportion of the total number of children at each age who were attending State schools. In the present graph (No. 55) the representation given is that of the proportion of the total State school pupils of all ages in the Commonwealth who were of each age. This representation is not given separately for the several States, as the State curves are very similar to each other and to that for the Commonwealth as a whole. The base of each small rectangle represents a year of age, and the vertical height represents two per cent.

In the succeeding table a comparison is furnished between the enrolment of State school children in 1910 and 1911, the average attendance in each of those years, and the number attending State schools according to the Census results.

State School Children. Enrolment, Average Attendance and Census Results, 1910 and 1911.

			STAT	es.			TERRITO	ORIES.	,
Particulars.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
Enrolment, 1910	* 218,539	206,263	89,695	* 52,929	32,664	27,820	*	*	627,910
Enrolment, 1911	223,299	204,086	91,624	55,662	34,969	28,821	85	304	638,850
Aver. Attendance, 1910	* 157,498	145,968	69,439	* 37,549	27,442	17,974	*	*	455,870
Aver. Attendance, 1911	160,593	146,464	70,194	38,727	29,448	18,130	60	183	463,799
Census Results,									
3rd April, 1911	212,753	179,400	88,943	50,542	35,617	25,504	74	226	593,059

<sup>\*</sup> For 1910 the New South Wales figures include those for the Federal Territory, and the South Australian figures include those for the Northern Territory.

Unfortunately the statistics of enrolments are not entirely satisfactory, as the methods of record are not uniform in the several States, and the allowances made for duplicate enrolments are usually on a basis which is more or less arbitrary. Further, the number of pupils whose names are on the rolls at any time during a given year will necessarily be greater than the number actually attending school at a specified date during the year, since those who left prior to the specified date or were admitted subsequently thereto will appear on the rolls, but not in the record of those attending school at the specified date.

In all cases the recorded enrolment for 1911 exceeds, as it should, for the reasons indicated

In all cases the recorded enrolment for 1911 exceeds, as it should, for the reasons indicated above, the Census results for 3rd April, 1911, except in that of Western Australia, where the Census results are slightly in excess. For the Commonwealth as a whole, the enrolments exceed the Census results by 45,791, or 7.72 per cent., an excess which is barely sufficient to allow for departures between 1st January and 3rd April, 1911, and admissions between 3rd April and 31st December, 1911. Taking into account the admitted uncertainty of enrolment figures, it is thus evident that the Census enumeration of State school children has been very complete.

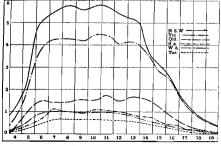
8. Private School Pupils.—The number of children of each year of age attending private schools at the date of the Census is given in the succeeding table.

Attending Private Schools (sexes combined), 1911.

A	LGE LAST			STAT	res.			TERRIT	ORIES.	<u> </u>		
В	IRTHDAY.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH		
Under 5		 1,262	785	314	198	260	115			2,934		
5		 2,947	2,163	985	385			- 1				
6		 5,114	3,862	1,425	694				1			
7		 5,508	4,227	1,439	1,063				1			
8 9		 5,721	4,250	1,443	1,018		$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$					
9		 5,606	4,211	1,526	970			3 2,934 7,298 3 7,298 5 13,880 1 14,079 8 14,079 8 14,079 1 14,380 1 13,495 1 13,089 2 10,980 2 3 8,489 3 8,489 6 10,980 8 10,980 8 10,980 8 10,980 8 10,980 8 10,980 8 10,980 8 10,980 8 10,980 8 10,980 8 10,980 8 10,980 8 10,980 8 10,980 8 10,980				
10		 5,741	4,415	1,535	1,073	965						
11		 5,689	4,385	1,689	1,073	956	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$					
12		 5,358	4,098	1,527	999	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$						
13		 5,141	4,111	1,649	851	788	547	1	1			
14		 3,967	3,599	1,567	762	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$						
15		 3,071	2,808	1,220	585	450	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$					
16		 2,305	2,248	773	422	W.A.         Tas.         N.T.         F.T.         C'wlth.           260         115          2,934           560         255         3          7,298           928         446         4         1         12,474           996         639         7         1         13,880           988         651         8          14,079           942         648         5          13,908           965         644         7          14,380           956         617         10          14,419           913         596         4          13,495           788         547         1         1         13,089           450         352         3          8,489           345         248         1          6,342           208         99         2          3,698           136         53         1          2,173           49         26          1,253		248	248			
17		 1,413	1,313	417	246	208	99	Tas.         N.T.         F.T.           115          2,934           255         3          7,298           446         4         1         12,474           639         7         1         13,880           651         8          14,079           648         5          13,908           644         7          14,380           617         10          14,419           596         4          13,495           547         1         1         13,089           462         1          10,980           352         3          8,489           248         1          6,342           99         2         3,698           53         1         2,173				
18		 819	778 991 187 126 59 1	776 221 167 136 53 1	991 187 198 59 1	18 991 187 128 52 1	778 991 187 126 59 1	991 187 198 59 1	991 187 198 59 1	21 167 136 53 1	36 53 1	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
19		 495	463	111	109	49	26			1,253		
20 and o	over	 1,597	878	223	263	164	90			3,215		
Тот	AL	 61,754	48,592	18,064	10,878	10,270	6,488	57	3	156,106		

The maximum number at any age was at age 11 for the Commonwealth as a whole and in Queensland, at age 10 in New South Wales and Victoria, at ages 10 and 11 in South Australia, at age 7 in Western Australia, and at age 8 in Tasmania. The average ages of the private school

Number of Private School Pupils, States and Ages, 1911.



GRAPH No. 56.

pupils were as follows:—Commonwealth, 10.69 years; New South Wales, 10.63; Victoria, 10.82; Queensland, 10.75; South Australia, 10.83; Western Australia, 10.27; Tasmania, 10.50; Northern Territory, 9.91; and Federal Territory, 8.67. For the Commonwealth as a whole the average age of private school pupils was 1 year and 3 months greater than that of State school pupils (see p. 184, ante).

In Graph No. 56 is furnished a representation of the number of Private school pupils (sexes combined) in each State at each age. The base of each small rectangle represents a year of age, and the vertical height 1000 pupils.

The proportion per cent. of the total children at each age who were attending private schools is shewn in the following table.

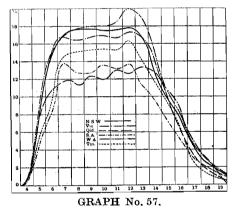
Proportion per cent. attending Private Schools (sexes combined), 1911.

Δa	E LAST				STAT	es.		i	Territ	ORIES.	
	THDAY.		N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	F.T. C'WLTE
Under 5			.63	.55	.43	.42	.74	.46			.56
5			8.05	8.00	7.61	4.49	8.73				
6			14.44	14.58	10.68	8.30	15.10	9.72			
7			17.04	16.70	11.75	13.43	16.90	14.57		2.70	
8			17.59	16.48	11.49	12.80	17.72	15.01			
9			17.64	16.67	12.19	12.76	17.94	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			
8 9 10			17.52	16.88	12.02	13.47	18.02	15.36	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		
11			17.58	16.72	12.86	13.29	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				
12			17.73	17.22	12.74	13.46	19.77	16.12	13.79		
13			16.67	16.66	13.27	11.28	18.87	14.07	5.00	2.86	
14			12.67	14.04	12.78	9.44	14.95	11.58	5.00		
15			9.57	10.61	9.60	7.06	10.55	9.16	10.34		
16			7.14	8.29	6.17	4.88	7.97	6.20	4.35		
17			4.23	4.78	3.23	2.85	4.46	2.49	6.25		
18			2.40	2.75	1.68	1.91	2.82	1.27	2.70		
19			1.50	1.70	.87	1.23	1.04	.68			1.39
20 and ov		٠.	.17	.11	.06	.11	.10	.09			.12
ALL	Ages		3.75	3.69	2.98	2.66	3.64	3.39	1.72	.17	3.50

The maximum proportion for the Commonwealth as a whole, as well as for the States of New South Wales, Victoria, Western Australia, and Tasmania was at age 12, the maximum in the case of Queensland being at age 13, and for

South Australia at age 10.

Proportion of Private School Pupils, States and Ages, 1911,



Graph No. 57 furnishes a representation of the proportion of children of each age in each State who were pupils at Private schools. The base of each small rectangle represents a year of age, and the vertical height representes two per cent. The most striking divergence between the several States in respect of this proportion is that shewn between Queensland on the one hand and Western Australia on the other.

The next table shews for each State and Territory the relative numbers of male and female pupils of private schools for each age. It gives under each head the excess of males over females per 100 of the sexes combined.

Masculinity of Private School Pupils (Excess of Males over Females per 100 of sexes combined), 1911.

A 00	E LAST				STAT	tes.			Territ	ORIES.	·
	THDAY.		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
Under 5			- 8.24	1.40	13.38	13.13	16.15	4.35		••	<b>4.98</b>
5			<b>2.88</b>	.88	<b>4.77</b>	8.05	1.07	3.53	100.00		- 1.64
6.			6.34	.31	<b>7.79</b>	2.02	3.23	<b>—</b> 1.79	.00		
7			<b></b> 5.92	-8.78	-14.11	3.67	- 13.65	5.79	<b>— 14.29</b>		
8			- 7.15	8.09	8.80	<b>— 8.64</b>	12.35	9.06	50.00		- 8.13
8 9			9.70	5.20	9.70	12.99	- 8.28	8.64	100.00		<b>—</b> 8.46
10			-10.82	-9.72	-18.18	-9.41	7.56	<b>4.04</b>	14.29		-10.63
11			10.60	8.28	-16.64	-10.90	15.48	-16.37	40.00		11.16
12			13.85	6.20	17.09		-12.16	<b></b> 7.05	50.00		10.47
13			-13.64	-3.87	-13.77	3.88	-14.97	11.88	100.00	100.00	9.95
14			-15.00	-4.03		5.51	-13.83	14.72	100.00		9.34
15			-11.04	28	13.28	16.24	- 16.44	22.73	100.00		- 6.66
16	• • • • • • • • • • • • • • • • • • • •	• •	-13.58	5.34	-16.95	2.84	-28.12	19.35	100.00		11.01
17	• • •	•	- 8.42	1.75	-25.18	11.38	<b>8.65</b>	7.07	100.00		- 5.30
18			3.54	.00	-22.17	31.74	.00	24.53	100.00		2.16
19			.61	25.27	.90	19.27	-14.29	.00			10.61
20 and or			<b>8.4</b> 5	38.95	48.88	35.36	68.29	57.78			17.82
ALL .	AGES		9.60	3.96	12.40	1.12	10.07	<b>7.98</b>	15.79	<b>— 100.00</b>	<b>—</b> 7.53

Note, -- denotes excess of females.

This table indicates that in all the States there is a preponderance of females amongst the private school pupils at the more important ages. For the Commonwealth as a whole this preponderance is in evidence at each age to 17 inclusive. It is least in evidence in South Australia, where there is a preponderance of males at all ages below 6 and above 13.

The age distribution per cent. of the private school pupils in each of the State 3 and Territories was as follows :-

Age Distribution	per	cent.	of	Private	School	Pupils	(sexes	combined).	1911.
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AGE	LAST			STAT	res.			TERRI	PORIES.	
BIRT	HDAY.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
Under 5		 2.04	1.61	1.74	1.81	2.53	1.77			1.88
5		 4.77	4.45	5.45	3.54	5.45	3.93	5.26		4.68
6		 8.28	7.95	7.89	6.38	9.04	6.87	7.02	33.33	7.99
7		 8.92	8.70	7.97	9.78	9.70	9.85	12.28	33.34	8.89
8 9		 9.26	8.75	7.99	9.36	9.62	10.03	14.04		9.02
		 9.08	8.67	8.45	8.92	9.17	9.99	8.77		8.91
10		 9.30	9.08	8.50	9.86	9.40	9.93	12.29	• • •	9.21
11		 9.21	9.02	9.35	9.86	9.31	9.51	17.55		9.24
<b>12</b>		 8.68	8.43	8.45	9.18	8.89	9.19	7.02		8.65
13		 8.32	8.46	9.13	7.82	7.67	8.43	1.75	33.33	8.38
14		 6.43	7.41	8.68	7.01	6.06	7.12	1.75		7.03
15		 4.97	5.78	6.75	5.38	4.38	5.42	5.26		5.44
16	٠.	 3.73	4.63	4.28	3.88	3.36	3.82	1.75		4.06
17		 2.29	2.70	2.31	2.26	2.02	1.53	3.51		2.37
18		 1.33	1.60	1.22   1.54   1.32   .82   1.75	1 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1		_ ; ;			1.39
19		 .80	.95	.61	1.00	.48	.40		• • • • • • • • • • • • • • • • • • • •	.80
20 and ove	r	 2.59	1.81	1.23	2.42	1.60	1.39		•••	2.06
TOTAL		 100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Graph No. 58 represents the proportion per cent. of the total Private school pupils in the Commonwealth who were at each age. The base of each small rectangle represents a year of

## Proportionate Age Distribution of Private School Pupils, Commonwealth, 1911.

age, and the vertical height represents two per cent. The curve for the Commonwealth gives a fair indication of the curves for the several States.

Of the total number of private school pupils in the Commonwealth 70.29 per cent. were aged from 6 to 13 last birthday, the corresponding proportions for the several States and Territories being as follows:—New South Wales, 71.05 per cent.; Victoria, 69.06 per cent.; Queensland, 67.73 per cent.; GRAPH No. 58.

South Australia, 71.16 per cent.; Western Australia, 72.80 per cent.; Tasmania, 73.80 per cent.; Northern Federal Territory, 100 per cent.

In the following table is given a comparison between the enrolment of children attending private schools in 1910 and 1911, the average attendance in each of those years and the number of private school pupils according to the Census results.

Private School Pupils.—Enrolment, Average Attendance and Census Results, 1910 and 1911.

D			STA	TES.			Territ	ORIES.	
Particulars.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH.
Enrolment, 1911	* 59.247 60,963 * 49,351 51,569 61,754	54,740 55,893 44,000 45,000	16,320 16,100 13,950 13,560 18,064	* 11,334 11,650 * 9,408 9,395	9,400 9,000 7,563 8,015	7,653 7,138 5,600 5,009	* 50 * 40	*  * 	158,694 160,794 129,872 132,588 156,106

<sup>\*</sup> For 1910 the New South Wales figures include those for the Federal Territory, and the South Australian figures include those for the Northern Territory.

The remarks on p. 186 relative to the comparison of enrolment statistics and Census results in respect of State school pupils applies to a large extent in the present instance, with the addition that in the case of private schools the enrolment statistics are even less satisfactory than is the case with State schools.

It will be seen that in five instances, viz., in New South Wales, Queensland, Western Australia, the Northern Territory, and the Federal Territory, the Census results exceeded the enrolment figures for 1911, while in the cases of Victoria, South Australia and Tasmania the enrolment figures for 1911 were in excess. For the Commonwealth as a whole the enrolment figures for 1911 exceeded the Census results by only 4688.

9. **Education "At Home.**"—Of the total of 775,390 returned as receiving education at the date of the Census, 23,760, or about 3 per cent., were classed as receiving education "at home." The number of such in each year of age is given in the following table:—

Age	E LAST			STATI	es.			TERRIT	ories.	
	HDAY.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
Under 5		 163	71	31	12	40	11		2	330
5		 1,367	704	564	246	272	154		1	3,308
6		 1,711	781	649	260	280	214	4	4	3,903
7		 1,318	<b>480</b>	490	211	248	204	4	6	2,961
8 9		 1,077	372	458	151	174	147	1	2	2,382
		 1,007	288	450	150	155	145	2	9	2,206
10		 835	<b>273</b>	354	133	152	130	2	4	1,883
11		 721	261	349	126	108	103	1	5	1,674
12		 641	236	275	80	81	84	1	· 4	1,402
13		 584	175	282	71	72	65	1	2	1,252
14		 379	168	169	61	46	67		1	891
15		 264	121	87	37	29	34	1		573
16		 155 -	77	47	24	14	14			331
17		 87	49	34	22	8	9		1	210
18	٠	 62	47	14	10	4	8			145
19		 29	39	6	6	6	4			90
20 and ov	e <b>r</b>	 115	58	10	18	10	7	1		219
Total		 10,515	4,200	4,269	1,618	1,699	1,400	18	41	23,760

Receiving Education "At Home" (sexes combined).

The maximum number at any age receiving education at home was at age 6 in the case of each of the States.

The proportion per cent. of the total children at each age who were classed as receiving education "at home" is shewn in the succeeding table :—

Territories.			ES.	STAT			LAST	Age
Tas. N.T. F.T.	Tas.	w.a.	S.A.	Q'land.	Vic.	N.S.W.	HDAY.	вікт
.05 1.10 .0	.05	.11	.02	.04	.05	.08	 	Under 5
3.33 2.50 3.4	3.33	4.24	2.87	4.36	2.60	3.74	 	5
4.67	4.67	4.55	3.11	4.86	2.95	4.83	 	6
4.65   $9.09$   $16.22$   $3.3$	4.65	4.21	2.67	4.00	1.90	4.08	 	7
3.39   $2.85$   $8.00$   $2.6$	3.39	3.12	1.90	3.64	1.44	3.31	 	8 9
3.42	3.42	2.95	1.97	3.60	1.14	3.17	 	9
3.10 6.45 10.26 2.1	3.10	2.84	1.67	2.77	1.04	2.55	 	10
2.55 4.00 17.86 19.8	2.55	2.09	1.56	2.66	1.00	2.23	 	11
$egin{array}{ c c c c c c c c c c c c c c c c c c c$	2.27	1.75	1.08	2.29	.99	2.12	 	12
1.67   5.00   5.71   1.5	1.67	1.72	.94	2.27	.71	1.89	 	13
1.68 2.08 1.0	1.68	1.10	.75	1.38	.66	1.21	 	14
.88 3.456	.88	.68	.45	.69	.46	.82	 	15
.35	.35	.32	.28	.37	.28	.48	 	16
.22 2.17	.22	.17	.26	.26	.18	.26	 	17
.19	.19	.08	.11	.11	.17	.18	 	18
.10       1	.10	.13	.07	.05	.14	.09	 	19
.01 .04	.01	.01	.01	٠.	.01	.01	 e <b>r</b>	20 and ov

Proportion per cent. Receiving Education "At Home" (sexes combined).

Amongst the States the highest proportion receiving education "at home" was furnished by Queensland for ages 5, 6, 8, 9, 11, 12, and 13; by Western Australia for ages "under 5" and for 10; and by Tasmania for ages 7, 14 and 15. For the population as a whole Tasmania furnished the highest proportion, Queensland being second and New South Wales third.

The next table shews for each State and Territory the relative number of males and females of each age being educated "at home." It gives under each head the excess of males over females per 100 of the sexes combined.

Masculinity of Children being Educated "At Home" (Excess of Males over Females per 100 of sexes combined), 1911.

Age	LAST				STAT	res.			TERRIT	TORIES.	
BIRT	HDAY.		N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
Under 5			5.52	29.58			50.00	45.45		100.00	
5			- 3.00	13.92		14.63	<b> 4.4</b> 1	.00		<b></b> 100.00	-5.68
6			<b>— 8.12</b>	12.42	- 5.08	<b></b> 7.69	2.86	<b>— 14.02</b>	100.00	.00	8,28
7 8 9			<b></b> 6.53	13.75	18.37	1.42	<b>— 14.52</b>	1.96	<b>50.00</b>	33.33	-9.42
8	٠.	• •	- 5.11	- 9.14		16.56	1.15	<b> 22.45</b>	100.00	100.00	<b>—</b> 6.55
			6.45	9.72	<b> 2.22</b>	18.67	20.00	15.86	100.00	55.56	8.07
10			<b> 12.81</b>	<b></b> 15.02	4.52		22.37	10.77	.00		12.27
11			-14.56	20.31	3.15	<b></b> 11. <b>1</b> 1	12.96	22.33	100.00	<b>— 20.00</b>	<b></b> 13.14
12			<b>—</b> 18.88	<b>— 14.41</b>	6.18	<b>2.50</b>	3.70	2.38	100.00	` 50.00	11.98
13			<b>— 14.38</b>	33.71	<b> 4.96</b>	21.13	5.56	23.08	100.00	100.00	15.18
14			-24.54	26.19	26.63	<b></b> 21.31	.00	<b>— 19.40</b>		100.00	23.23
15			27.27	22.31	31.03	<b> 45.95</b>	10.34	.00	<b> 100.00</b>		25.65
16			-30.32	14.29	- 31.91	50.00	14.29	100.00			23.87
17			8.05	<b>— 10.20</b>	11.76	27.27	50.00	55.56		100.00	14.29
18			12.90	- 2.13	14.29	<b>40.00</b>	50.00	50.00			- 3.45
19 .	٠.		3.45	48.72	33.33	.00	- 33.33	.00			17.78
20 and ove	r		46.09	68.97	60.00	55.56	80.00	42.86	100.00		55.25
ALL A	GES	٠.	- 9.04	11.81	6.72	12.11	- 9.36	12.00	22.22	21.95	- 9.44

This table indicates a preponderance of females amongst those being educated "at home," at practically all ages in all the States, the preponderance being least marked in the case of Queensland for the ages 8 to 13 last birthday.

The age distribution per cent. of the children being educated "at home" in each of the States and Territories was as follows:—

Age Distribution per cent. of Children being Educated "At Home" (sexes combined), 1911.

Age	LAST			STAT	res.			TERRIT	ORIES.	
BIRTH	DAY.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
Under 5		 1.55	1.69	.73	.74	2.35	.79		4.88	1.39
5		 13.00	16.76	13.21	15.20	16.01	11.00		2.44	13.92
6		 16.27	18.59	15.20	16.07	16.48	15.29	22.22	9.75	16.43
7		 12.54	11.43	11.48	13.04	14.60	14.57	22.22	14.63	12.46
8 9	٠.	 10.24	8.86	10.73	9.33	10.24	10.50	5.56	4.88	10.03
9		 9.58	6.86	10.54	9.27	9.12	10.36	11.11	21.95	9.28
10		 7.94	6.50	8.29	8.22	8.95	9.29	11.11	9.76	7.93
11		 6.86	6.21	8.17	7.79	6.36	7.36	5.56	12.19	7.05
12		 6.10	5.62	6.44	4.95	4.77	6.00	5.56	9.76	5.90
13		 5.55	4.17	6.61	4.39	4.24	4.64	5.56	4.88	5.27
14		 3.60	4.00	3.96	3.77	2.71	4.78		2.44	3.75
15		 2.51	2.88	2.04	2.29	1.71	2.43	5.55		2.41
16		 1.47	1.83	1.10	1.48	.82	1.00			1.39
17		 .83	1.17	.80	1.36	.47	.64		2.44	.88
18	٠.	 .59	1.12	.33	.62	.23	.57			.61
19		 .28	.93	.14	.37	.35	.28			.38
20 and ove	r	 1.09	1.38	.23	1.11	.59	.50	5.55		.92
TOTAL	٠	 100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Of the total number in the Commonwealth being educated "at home," 74.35 per cent. were aged from 6 to 13 last birthday, the corresponding proportions for the several States and Territories being as follows:—New South Wales, 75.08 per cent.; Victoria, 68.24 per cent.; Queensland, 77.46 per cent.; South Australia, 73.06 per cent.; Western Australia, 74.76 per cent.; Tasmania, 78.01 per cent.; Northern Territory, 88.90 per cent.; and Federal Territory, 87.80 per cent.

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7

11

19

284

539

69

116

22

10. University Students.—The number of University students at each age in each of the States is shewn in the following table:-University Students, 1911.

C'wlth. W.A. Tas. AGE LAST BIRTHDAY. N.S.W. S.A. MALES 30 1216 2  $2\dot{5}$ 5 10236 93  $\begin{array}{c} \bf 34 \\ 120 \end{array}$ 17 . . . . . . 32 5 259 9 18 ٠.  $\frac{7}{16}$ 270 26 4 19 . . . . 181 7 18 1,265 ٠. 501 542 20 and over 1.926 762820 34271 7 32 TOTAL . . . . . . . . FEMALES. 43 2 15 16 44 4 5 ٠. 18 13 . . ٠. 26 10 2 74 30 18  $\begin{array}{c} 44 \\ 112 \end{array}$ 94 3 8 17 19

			 	P.	ERSONS.					
16 17 18 19 20 and	   over Total	•••	 	27 54 123 146 583	21 47 146 156 654 1,024	2 6 14 10 24	22 30 42 43 250	 3 1 1 9 14	1 6 7 8 29	73 146 333 364 1,549

204

82

171

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20 and over

TOTAL

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As already mentioned on p. 178, the Queensland University was opened in March 1911, the Western Australian University in March 1913. The figures for the last-mentioned State consequently refer to students temporarily absent from their Universities.

The relative number of male and female students is shewn in the succeeding table.

Masculinity of University Students (Excess of Males over Females per 100 of sexes combined), 1911.

	AGE L	AST B	IRTHDAY	<b>7.</b>	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	C'wlth.
16 17 18 19 20 and	over	  	    Over		 18.52 33.33 51.22 65.75 71.87	14.29 44.68 64.38 43.59 65.75	- 100.00 - 33.33 28.57 40.00 33.33 - 21.43	- 36.36 66.67 52.38 20.93 44.80		$66.67 \\ 42.86 \\ .00 \\ 24.14$	55.56 48.35 63.33

Note, - denotes excess of females.

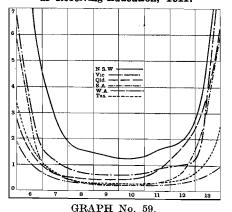
This table indicates a preponderance of females at age 16, but of males at all other ages, the tendency being for this latter preponderance to increase with age.

11. Not Indicated as Receiving Education.—Of the total of 701,834 children aged last birthday from 6 to 13 years, there were 64,609, or 9.21 per cent., who were not indicated as receiving education. The numbers for each age in each State and Territory are as follows: receiving education.

Children Not Indicated as Receiving Education (sexes combined). TERRITORIES. STATES. AGE LAST C'wlth. BIRTHDAY. N.T. F.T. S.A. W.A. Tas. N.S.W. Vic. Q'land. 1,053  $\substack{1,812\\713}$ 19,689 10 3,620 1,528 2,988 8,657 6,451 3,706 3,142  $\mathbf{23}$ 2,798 1,580 662 462 1,143 643 . . 18 16 690 486 302 307 323  $\frac{8}{9}$ 6 421 477 784  $\begin{array}{c} 203 \\ 212 \end{array}$ 285 615 245 1,351 ٠. 206 235 12 3,036 1,265 1,530 623 325242302 8 8 9 7 4.038 839 11 15  $\overline{12}$ 1,690 746 315 448 . . 3,275 1,238 18,304 653 5,290 3,970 3,860 5,356 124 **53** 64,609 3,483 TOTAL, 6-13 24,45512,536 9,889 8,713

In all the States the numbers were largest at the extreme ages of 6 and 13 last birthday, the totals for these two ages aggregating 37,993, or nearly 59 per cent. of the total aged last birthday from 6 to 13 who were not indicated as

Number of Children, aged 6-13, not indicated receiving education.
as Receiving Education, 1911.



In the accompanying graph (No. 59) is given a representation of the number of children in the several States aged 6 to 13 last birthday who were not indicated as receiving education. The base of each small square represents a year of age, and the vertical height represents 1000 children.

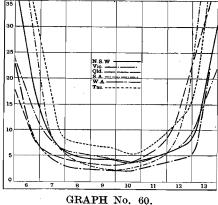
The proportion per cent. of the total children at each age represented by those not indicated as receiving education is shewn in the following table for each State and Territory :---

Proportion per cent. not Indicated as Receiving Education (sexes combined), 1911.

Ac	E LAST				STAT	ES.			TERRITO	RIES.	
BII	RTHDAY.		N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth.
6			24.45	13.66	11.45	35.72	17.13	39.49	63.64	28.57	20.86
7			8.65	4.51	5.25	8.37	7.84	16.25	52.27	18.92	7.32
8			4.86	2.67	3.87	3.80	5.51	7.45	51.43		4.17
9			4.25	2.44	3.36	2.67	4.67	6.72	48.49	13.33	3.62
10			3.86	2.38	3.74	2.66	3.85	5.61	38.71	15.38	3.40
11			4.73	3.20	5.98	4.03	4.67	7.49	32.00	28.57	4.53
12			6.56	4.35	14.09	10.05	6.82	12.11	51.73	21.95	7.63
13	• •	•••	17.16	16.09	31.06	43.39	15.64	31.85	55.00	20.00	21.89
Age	s, 6–13		9.47	6.15	9.79	13.87	8.26	16.05	49.60	18.60	9.21

Amongst the States, Victoria had the lowest proportion not indicated as receiving education for all ages except 6, for which Queensland was the lowest, and 13, for which Western Australia

Proportion of Children, aged 6-13, not indicated as Receiving Education, 1911.



was the lowest. On the other hand, Tasmania had the highest proportion amongst the States at all ages except 12, for which Queensland was the highest, and 13, for which South Australia was the highest.

Graph No. 60 furnishes for each State a representation of the proportion of the total children (sexes combined) at each age who were not indicated as receiving education. The base of each small square ceiving education. The base of each small square represents a year of age, and the vertical height represents five per cent.

The following table shews for each State and Territory the relative number of males and females of each age who were not indicated as receiving education.

Masculinity of Children not indicated as Receiving Education (Excess of Males over Females per 100 of sexes combined), 1911.

• Ag:	E LAST				STAT	res.			TERRIT	TORIES.	
BIR	THDAY.		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
6			_ 2.74	5.14		2.95	10.73	3.20	4.76	60.00	3.01
7			-9.22	<b>—</b> 8.84	3.58	5.14	- 4.33	3.51	4.35	-42.86	-3.01 -4.67
8			<b>4.30</b>	-12.17	12.76	10.60	- 3.58	6.50	11.11		- 4.07 - 2.97
9			- 5.40	<b>— 3.41</b>	11.16	1.48	2.86	4.56	37.50	100.00	76
10 -			- 9.72	11.08	3.56	6.60	-18.45	13.19	-16.67	- 100.00	-1.25
11			- 1.05	<b>—</b> 1.55	.00	2.77	- 8.26	5.30	25.00	.00	1.09
12			10.38	<b> 2.70</b>	4.14	1.07	6.67	8.48	- 20.00	11.11	1.62
13	• •	• •	4.50	3.22	3.26	5.28	1.99	10.34		14.29	.39
Ages,	6-13		- 4.98		3.17	1.18	4.62	6.16	1 <b>1.</b> 29	1.89	1.76

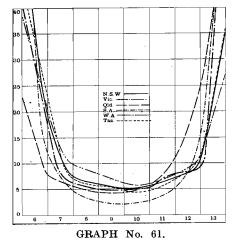
For the Commonwealth as a whole there was a slight proponderance of females at all ages except 13. General preponderances of females were in evidence in New South Wales, Victoria, Western Australia and Northern Territory, and of males in Queensland, South Australia, Tasmania and Federal Territory.

The age distribution per cent. of the children of school age in each State who were not indicated as receiving education is shewn in the succeeding table:—

Age Distribution per cent. of Children not indicated as Receiving Education (sexes combined).

AG	E LAST				STAT	ES.			TERRITO	RIES.	
	PHDAY.		N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTE
6			35.40	28.88	15.45	34.29	30.23	33.83	16.93	18.86	30.47
. 7			11.44	9.12	6.50	7.60	13.27	13.31	18.55	13.21	9.99
8			6.46	5.50	4.92	3.47	8.81	6.03	14.52		5.74
9			5.53	4.90	4.26	2.33	7.03	5.32	12.90	11.32	4.86
10			5.17	4.97	4.82	2.43	5.92	4.39	9.68	11.32	4.70
11			6.26	6.70	7.93	3.73	6.95	5.64	6.45	15.10	6.25
12			8.11	8.26	17.09	8.56	9.04	8.37	12.10	16.98	9.66
13		٠.	21.63	31.67	39.03	37.59	18.75	23.11	8.87	13.21	28.33
$\mathbf{r}$	OTAL		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

#### Proportionate Age Distribution of Children, aged 6-13, not indicated as Receiving Education, 1911.



For the Commonwealth as a whole, as well as for New South Wales, Western Australia and Tasmania the proportion was at a minimum at age 10, whilst for Victoria, Queensland and South Australia the minimum was at age 9.

In Graph No. 60 a representation was given for each State of the proportion of the total number of children of each age who were not indicated as receiving education. In the present graph (No. 61) the representation furnished for each State is that of the proportion of the total children aged 6-13 not indicated as receiving education who were of each age. The base of each small square represents a year of age, and the vertical height represents five per cent.

12. Pupils in Metropolitan Areas.—Particulars in respect of the number of pupils in the metropolitan areas of the several States are furnished in the succeeding table:—

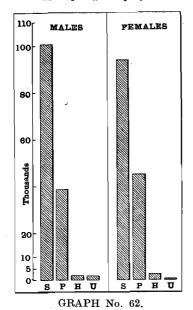
Metropolitan Schooling as at 3rd April, 1911.

Metropol	TTAN	AREAS	INCLU	DING	Numbei	RECEIVING	EDUCATION	7 AT	Number not indicated	Тольт
METIOLOF		BURBS.	11(020)	2110	State School.	Private School.	Home.	Uni- versity.	as receiving education.	TOTAL.
						MALES.				
Sydney					36,399	13,875	778	684	253,992	305,728
Melbourne	• •				33,276	14.306	640	770	228,964	277,956
Brisbane	• •				10,137	2,651	125	26	54,689	67,628
Adelaide					10,858	3,757	137	257	75,569	90,578
Perth					7.892	2,716	117	4	42,502	53,231
Hobart	th,				1,968	1,231	55	25	15,208	18,487
Total,	Metr	OPOLIT	'AN		100,530	38,536	1,852	1,766	670,924	813,608
						FEMALES.				
Sydney					33,414	17,319	1,085	149	271,808	323,775
Melbourne	• •	• •		• •	31,386	15,658	845	188	262,938	311,015
Brisbane					9,354	3,390	171	18	58,919	71,852
Adelaide		• •			10.571	3,896	212	113	84,276	99,068
Perth	· •		• • •		7.342	3,252	243	3	42,721	53,561
Hobart	• •				1,841	1,411	77	18	18,103	21,450
Total,	Метн	ROPOLIT	CAN		93,908	44,926	2,633	489	738,765	880,72

Metropolitan	Schooling	ac at	3rd April	1911 —	continued.
TITCAT ANATIOTIT	DULLUULLE	00 au	OIR WAITI	TOTT.	TO TOU DIE COOL.

Metropoi	ITAN .	Areas	INCLUI	DING	Numbe	R RECEIVIN	EDUCATIO	N AT	Number not indicated		
	Sui	BURBS.			State School.	Private School.	Home.	Uni- versity.	as receiving education.	TOTAL.	
	*					PERSONS					
Sydney					69,813	31,194	1,863	833	525,800	629,503	
Melbourne					64,662	29,964	1,485	958	491,902	588,971	
$\mathbf{Brisbane}$					19,491	6,041	296	44	113,608	139,480	
$\mathbf{Adelaide}$					21,429	7,653	349	370	159,845	189,646	
$\mathbf{Perth}$					15,234	5,968	360	7	85,223	106,792	
Hobart	·	• •	• •	• •	3,809	2,642	132	43	33,311	39,937	
Total	, Met	ROPOLI	TAN		194,438	83,462	4,485	2,255	1,409,689	1,694,329	

#### Metropolitan Pupils, 1911.



In this table the column headed "Number not indicated as receiving education" includes persons above school age as well as those of school age concerning whom no such indication was furnished.

As previously indicated the small number of University students shewn for Perth was due to the fact that the Western Australian University had not been opened at the date of the Census, the 7 students shewn being members of other Universities who were resident in Western Australia.

In Graph No. 62 a representation is furnished of the number of pupils attending each class of school, etc., within the metropolitan areas. The letter S indicates State school pupils, the letter P Private school pupils, the letter H indicates those being educated at home, while the letter U indicates University students.

The following table shews for each of the metropolitan areas the proportionate distribution per cent. of the children receiving education according to class of school, etc.

Proportionate Distribution of Metropolitan Pupils according to Class of Institution, 1911.

							Prop	ORTION PER EDUCAT	CENT. REC	EIVING	_
METROP	OLITA	n Are	AS INC	LUDIN	g Subt	JRBS.	State School.	Private School.	Home.	Uni- versity.	TOTAL
							MALES.				
Sydney							70.36	26.82	1.50	1.32	100.00
Melbourne							67.92	29.20	1.31	1.57	100.00
Brisbane							78.34	20.49	.97	.20	100.00
Adelaide							. 72.35	25.03	.91	1.71	100.00
Perth						٠.	73.56	<b>25.3</b> 1	1.09	.04	100.00
Hobart	• •	• •	• •				60.02	37.54	1.68	.76	100.00
ALL M	[ETRO	POLITA	n Are	AS			70.45	27.01	1.30	1.24	100.00
				,			FEMALES	S.			
Sydney			•••				64.30	33.33	2.09	.28	100.00
delbourne							65.28	32.57	1.76	.39	100.00
Brisbane	• •						72.33	26.21	1.32	.14	100.00
delaide							71.47	26.34	1.43	.76	100.00
$\operatorname{erth}$							67.73	30.00	2.24	.03	100.00
${f Hobart}$	• •	• •		٠,			55.00	42.16	2.30	.54	100.00
ALL M	[ETRO]	POLITA	n Are	AS			66.15	31.65	1.86	.34	100.00

# Proportionate Distribution of Metropolitan Pupils according to Class of Institution.—continued.

							Ркоро	ORTION PER. EDUCAT	CENT. RECE	CIVING	
METROPO	LITAN	AREA	S INCI	UDING	Subui	RBS.	State School.	Private School.	Home.	Uni- versity.	TOTAL
							PERSONS	l.			
Sydney							67.32	30.08	1.80	.80	100.00
Melbourne			٠.				66.61	30.87	1.53	.99	100.00
Brisbane		, .					75.34	23.35	1.14	.17	100.00
Adelaide							71.91	25.68	1.17	1.24	100.00
Pe <b>rt</b> h							70.63	27.67	1.67	.03	100.00
Hobart	• •	• •					<b>57.4</b> 9	39.87	1.99	.65	100.00
ALL M	IETRO	POLITA	n Are	AS	• •		68.31	29.32	1.58	.79	100.00

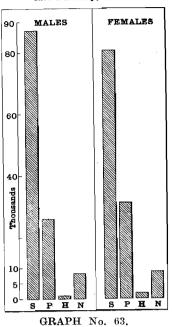
Of those recorded as receiving education at the date of the Census, Brisbane furnished the highest proportion at State schools, and the lowest at private schools and "at home," while Hobart furnished the lowest proportion at State schools, and the highest at private schools and "at home."

In the following table is given for each of the metropolitan areas the number of children of what has been termed "compulsory school age," that is, children aged from 6 to 13 last birthday who were receiving education at each class of school, etc.

## Metropolitan Children Aged last Birthday from 6 to 13 Years.

3.5	OLITAN AREAS INCLUDING SUBURBS.							BER RECEIV	Number not indicated	m		
METROPO	METROTOMITAN AREAS INCHEDING SUBURDS.							State Private School. Home		as receiving education.	Total.	
							MALES					
Sydney					•••		31,132	9,420	390	2,773	43,715	
Melb <b>ourn</b> e	• •		• • •	• •		• •	29,056	9,574	380	2,313	41,323	
Brisbane		• •	• • •	• • •		• • •	8.741	1,707	72	661	11,181	
Adelaide		• •					9,845	2,338	88	1,588	13,859	
Perth			• • •				6,621	1,823	59	386	8,889	
Hobart				• • •			1,699	893	37	413	3,042	
TOTAL	, Ме	TROPOI	LITAN				87,094	25,755	1,026	8,134	122,009	
Sydney Melbourne Brisbane Adelaide							28,377 27,242 8,013 9,263	11,852 11,061 2,197 2,828	720 539 103 120	3,136 2,361 760 1,570	44,085 41,203 11,073 13,781	
Perth							6,123	2,301	147	469	9,040	
Hobart	• •	• •	• •	• •	• •		1,585	981	52 ·	398	3,016	
TOTAL	, Ме	TROPOL	ITAN		••		80,603	31,220	1,681	8,694	122,198	
		-										
	•						PERSONS	<b>.</b> .				
								:				
Sydney							59,509	21,272	1,110	5,909	87,800	
Melbourne							56,298	20,635	919	4,674	82,526	
Brisbane							16,754	3,904	175	1,421	22,254	
Adelaide							19,108	5,166	208	3,158	27,640	
							12,744	4,124	206	855	17,929	
							3,284	1,874	89	811	6,058	
Perth Hobart	• •	• •					·					

# Metropolitan Children, aged 6-13 last birthday, 1911.



It will be seen that for the combined metropolitan areas the total number of males, aged last birthday 6 to 13, was practically identical with the total number of females of the same age, and that this approximate equality of sexes was also in evidence in separate metropolitan areas. Females were slightly in excess in combined total, and also in Sydney and Perth, while males were slightly in excess in Melbourne, Brisbane, Adelaide, and Hobart.

Graph No. 63 furnishes a representation of the number of metropolitan children of each sex aged from 6 to 13 last birthday classified according to the class of school, etc., at which they were receiving education at the date of the Census. In this graph the letter S indicates State school pupils, the letter P indicates Private school pupils, the letter H denotes those receiving education at home, while the letter N denotes those who were not indicated as receiving education.

The succeeding table shews the proportion of children of "school age" receiving education at each class of school, etc.

Proportion of Children of "School Age" at each Class of School, etc.

								ON PER CENT	Proportion per cent. not in-	_		
METROPO	METROPOLITAN AREAS INCLUDING SUBURBS.							Private School.	Home.	dicated as receiving education.	Total.	
							MALES					
							71.22	21.55	.89	6.34	100.00	
ydney	• •		• •	• •	• •	• •	70.31	$\frac{21.55}{23.17}$	.92	5.60	100.00	
Melbourne	• •	• •	• •	• •	• •		78.18	15.27	.64	5.91	100.00	
Brisbane	• •	٠.	• •	• •			71.04	16.87	.63	11.46	100.00	
Adelaide Perth	• •	• •			• •	• •	74.49	20.51	.66	4.34	100.00	
erun Hobart		• •	• •	• •			55.85	29.35	1.22	13.58	100.00	
ALL M			м Арк				71.38	21.11	.84	6.67	100.00	
Sydney Melbourne Brisbane Adelaide Perth Hobart		  					64.37 66.12 72.37 67.22 67.73 52.55	26.89 26.84 19.84 20.52 25.45 32.53	1.63 1.31 .93 .87 1.63 1.72	7.11 5.73 6.86 11.39 5.19 13.20	100.00 100.00 100.00 100.00 100.00	
ALL N	LETRO.	POLITA	ARE	AS			PERSONS	1	1,00			
							PERSON	) <b>,</b>				
Sydney							67.78	24.23	1.26	6.73	100.00	
Melbourne							68.22	25.01	1.11	5.66	100.00	
							75.29	17.54	.79	6.38	100.00	
3risbane							69.13	18.69	.75	11.43	100.00	
							71.08	23.00	1.15	4.77	100.00	
Adelaide							54.21	30.93	1.47	13.89	100.00	
Brisbane Adelaide Perth Hobart							01.21	00.00		10.00	100.00	

Hobart had the highest proportion being educated at private schools, "at home," and not indicated, and the lowest at State schools. Brisbane had the highest at State schools and the lowest at private schools, while Adelaide had the lowest "at home," and Perth had the lowest not indicated.

Of the total of 244,207 children aged last birthday from 6 to 13 years in the various metropolitan areas of the Commonwealth, there were 16,828, or 6.89 per cent., who were not indicated as receiving education. The number for each age in each of the metropolitan areas is as follows:—

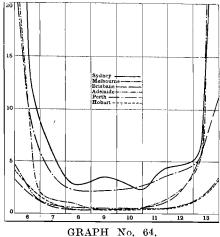
Metropolitan Children not indicated as Receiving Education (sexes combined).

Age	LAST	BIRTHI	AY.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total, Metro- politan
6				2,118	1,252	204	1,118	277	284	5,253
7				596	375	70	137	80	98	1,356
8				297	223	37	80	60	38	735
9				334	227	38	37	46	. 44	726
10				272	244	47	49	48	37	697
11				356	316	82	96	47	42	939
12				473	408	222	241	80	75	1,499
13			4.	1,463	1,629	721	1,400	217	193	5,623
To	TAL,	6-13		5,909	4,674	1,421	3,158	855	811	16,828

As in the case of the whole population, discussed on p. 192, the highest figures occur in each case at the limiting ages 6 and 13, the aggregate for those two ages being no less than 10,876,

or 64.63 per cent., of the Metropolitan total aged 6-13. Number of Metropolitan Children, aged 6-13, not indicated as receiving education.

Number of Metropolitan Children, aged 6–13, not indicated as Receiving Education, 1911.



The minimum number at any age occurred at age 10 for the combined metropolitan areas as well as for Sydney and Hobart; at age 8 for Melbourne and Brisbane; and at age 9 for Adelaide and Perth.

Graph No. 64 furnishes a representation of the number of children in each metropolis aged from 6 to 13 last birthday who were not indicated as receiving education. The base of each small rectangle represents a year of age, while the vertical height represents 500 children.

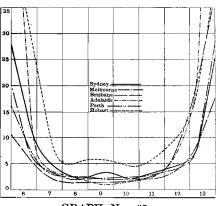
The proportion per cent. of the total children at each age represented by those not indicated as receiving education is shewn in the following table for each of the metropolitan areas.

Metropolitan Proportion per cent. not indicated as Receiving Education (sexes combined).

Age las:		Age last Birthday.			AST BIRTHDAY.		Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	All Metro- politan areas.
6 7 8 9 10 11 12 13				17.71 5.46 2.66 3.12 2.48 3.17 4.56 13.95	11.88 3.71 2.12 2.21 2.33 2.96 4.18 16.00	$\begin{array}{c} 7.37 \\ 2.55 \\ 1.35 \\ 1.41 \\ 1.64 \\ 2.80 \\ 8.35 \\ 25.32 \end{array}$	30.36 4.01 2.30 1.11 1.40 2.62 7.48 42.09	11.02 3.36 2.61 2.06 2.11 2.06 3.91 11.48	36.50 12.44 5.23 5.61 4.83 5.80 10.39 25.13	16.30 4.46 2.38 2.42 2.26 2.98 5.21		
A	GES,	6–13		6.73	5.66	6.39	11.43	4.77	13.39	6.89		

In this case the lowest proportions were shewn by Brisbane for ages 6, 7 and 8, by Adelaide for ages 9 and 10, and by Perth for ages 11, 12 and 13. The highest proportions were shewn by Hobart for all ages except 13, for which Adelaide occupied the highest position. For the Commonwealth as a whole the proportion of those of school age who were not indicated as receiving education was 9.21 per cent., as compared with 6.89 per cent. for the metropolitan areas. Stated somewhat differently, it may be said that the metropolitan proportion was 6.89 per cent. as compared with 10.44 per cent. for the extra-metropolitan population.

#### Metropolitan Proportion not indicated as Receiving Education, 1911.



GRAPH No. 65.

In Graph No. 65 is furnished for each metropolis a representation of the proportion of the total number of children (sexes combined) at each age, concerning whom there was no indication that they were receiving education. In this graph the base of each small square represents a year of age, while the vertical height represents five per cent.

The following table shews for each of the metropolitan areas the relative number of males and females of each age who were not indicated as receiving education. For the whole of the age group, 6-13 last birthday, there was an excess of males for the combined metropolitan areas, as well as for Sydney, Melbourne, Brisbane, and Perth, but an excess of females in Adelaide and Hobart.

Masculinity of Metropolitan Children not indicated as Receiving Education (Excess of Males over Females per 100 of sexes combined).

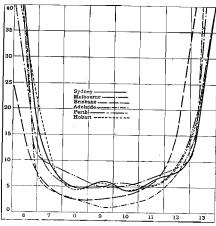
Age	7		Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	All Metro politan areas.	
6				8.78	3.99	3.92	4.83	19.13	2.82	6.83
7				15.44	13.60	25.71	- 8.03	27.50	<b>— 4.08</b>	12.39
8				-13.13	-4.04	-24.32	7.50	-6.67	-10.53	-8.03
9				- 7.19	3.08	10.53	24.32	-17.39	27.27	8.03 1.93
10				5.88	-5.74	31.91	-14.29	20.83	2.70	3.0
11				- 1.69	3.16	14.63	6.25	14.89	.00	32
12				11.21	4.41	18.92	.41	-12.50	-12.00	6.34
13				5.81	1.90	1.25	<b>4.57</b>	5.99	- 9.84	12
Ag	es, 6-	-13		6.14	1.03	6.97	57	9.71	1.85	3.3

The age distribution per cent. of the children of school age in each metropolitan area who were not indicated as receiving education is shewn in the succeeding table

Age Distribution per cent. of Metropolitan Children not indicated as Receiving Education (sexes combined).

Age	GE LAST BIRTHDAY.		LAST BIRTHDAY.		Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	All Metro politan areas.
6				35.84	26.79	• 14.36	35.40	32.40	35.02	31.22
7				10.09	8.02	4.93	4.34	9.35	12.08	8.06
8	٠.			5.03	4.77	2.60	2.54	7.02	4.68	4.37
9				5.65	4.86	$\frac{2.67}{2.67}$	1.17	5.38	5.43	4.3
10				4.60	5.22	3.31	1.55	5.62	4.56	4.14
11				6.02	6.76	5.77	3.04	5.50	5.18	5.58
12				8.01	8.73	15.62	7.63	9.35	9.25	8.91
13				24.76	34.85	50.74	44.33	25.38	23.80	33.41
AG	es, 6–	13		100.00	100.00	100.00	100.00	100.00	100.00	100.00

Proportionate Age Distribution of Metropolitan Children, aged 6-13, not indicated as Receiving Education, 1911.



GRAPH No. 66.

The accompanying graph (No. 66) furnishes a representation for each metropolis of the proportion of the total number of children (sexes combined), aged 6-13 last birthday not indicated as receiving education who were of each age. The base of each small square represents a year of age, and the vertical height represents five per cent.

13. State Sub-divisions.—Particulars in respect of schooling tabulated according to sex, age, and class of school are given for State and Territory Sub-divisions on pp. 633 to 743 inclusive of Vol. II. of the Census Detailed Tables, as follows:—New South Wales Counties, pp. 633 to 672; Victorian Counties, 673 to 684; Queensland Census Districts, 684 to 703; South Australian Counties and Divisions, 704 to 717; Western Australian Statistical Districts, 718 to 726; Tasmanian Municipalities, 726 to 741; Northern Territory, 741 to 742; Federal Territory,

# CHAPTER XV.

# RELIGION.

- 1. Nature of Inquiry.—Section 21 of the Commonwealth Census and Statistics Act 1905, under which the Census of 1911 was taken, contains the provision that "no person shall be liable to any penalty for omitting or refusing to state the religious denomination or sect to which he belongs or adheres." For refusal to furnish information in connexion with any other item of inquiry contained in the Census schedule, a maximum penalty of £10 is provided under Sections 11, 14 and 15 of the Act mentioned. In accordance with the provision of Section 21, the instruction relative to supplying information concerning religion was as follows:—"Do not use general terms that include more than one religious denomination or sect. In the case of children, enter the name of the religion in which it is intended they shall be brought up. If you object to state to what religious denomination you belong, write Object." On the personal card itself the query took the form simply of the word "Religion" with a blank space following it for the insertion of the appropriate particulars.
- 2. Object to State.—The total number of persons in the Commonwealth who availed themselves of the option of objecting to state their religion on the Census schedule was 83,003, or 1.86 per cent. of the total population. Of these 55,766 were males and represented 2.41 per cent. of the male population, while 27,237 were females and represented 1.27 per cent. of the female population. The corresponding percentages on total population for the several States and Territories were as follows:—New South Wales, 1.34 per cent.; Victoria, 1.67 per cent.; Queensland, 2.08 per cent.; South Australia, 3.74 per cent.; Western Australia, 2.18 per cent.; Tasmania, 2.58 per cent.; Northern Territory, 2.96 per cent.; and Federal Territory, 1.28 per cent. The range in the percentage of persons who objected to state their religion was thus between 1½ per cent. in the Federal Territory, and 3¾ per cent. in South Australia.
- 3. Religion Unspecified.—In addition to those who specifically objected to state their religion, there were 36,114 in the Commonwealth as a whole who failed to furnish any reply, representing about 8 per thousand of the total population. Of the male population considered separately those unspecified represented about 11 per thousand, and of the female population, somewhat less than 5 per thousand. In reviewing the results in the present chapter the number of those who objected to state their religion and of those who failed to furnish a reply have been distributed proportionately over the specified religions in the various categories.
- 4. Classification of Results.—For convenience of compilation and review the data relative to religions have been classed in six divisions as follows:—I. Christian; II. Non-Christian; III. Indefinite; IV. No Religion; V. Object to State; VI. Unspecified. The first four of these have been further divided into the principal denominations and sects comprised thereunder, making, with the classes "object to state" and "unspecified," a total of thirty items. Under these items particulars for each sex and for the sexes combined have been tabulated in respect of birthplaces (see pp. 238 to 291 of the Detailed Tables), and also in respect of age, education and conjugal condition (see pp. 772 to 825 of the Detailed Tables). These particulars are given for the Commonwealth as a whole as well as separately for each State and Territory. For the purposes of tabulation each card was marked in relation to religion with the appropriate number corresponding to one of these thirty items, and the principal tabulations proceeded on the basis of these numbers. For the use of the tabulators engaged on this work an index of religions was prepared. In the case of the conjugal condition cards, which were written up for the tabulation of the relative ages, birthplaces and religions of husbands and wives, the religion number was entered on the card.

In the general tabulation of religious data, however, an arrangement was made whereby the persons included in any of the 30 classified items were specially tabulated according to sex under the precise designations which they themselves furnished. The outcome of this tabulation disclosed the fact that no fewer than 1578 different designations had been furnished, of which 1206, or about  $76\frac{1}{2}$  per cent., were represented by less than ten persons each. These latter were for purposes of publication grouped with the designation "Others" under the denomination or sect to which they had been classified, but all designations represented by ten or more persons are published in full for each sex in respect of each State and Territory on pp. 751 to 770 of the Detailed Tables.

In this tabulation the various designations are arranged under the classified items in numerical order, according to the number of persons of both sexes representing each in the Commonwealth as a whole.

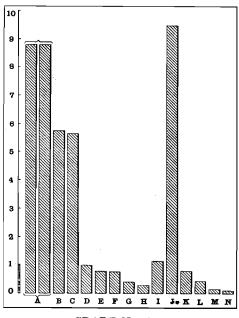
5. Aggregates for States and Territories.—After the distribution of the groups "object to state" and "unspecified" referred to in article 3 above, the figures for the total population of the several States and Territories were as follows:—

Numerical Distribution of Population according to Religion (sexes combined), 1911.

<b></b>			Sta	TES.			TERRIT	FORIES.	
RELIGION.	N. S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
CHRISTIAN—									
Church of England	748,493	462,388	219,614	119,385	112,975	91,255	678	685	1,755,473
Presbyterian	186,592			23,709		16,295	153	192	
Methodist	153,512			104,836	35,298	25,746	121	121	
Baptist	20,965	31,867	14,080	22,799	4,931	4,898	15		99,558
Congregational	23,008	16,831	10,735	13,940	6,376	5,032	25	1	75,948
Lutheran	7,177	11,906	24,843	27,794	2,561	202	25		74,508
Church of Christ	6,495	16,841	2,632	9,718	2,882	1,161	1	2	39,732
Salvation Army	7,533		4,431	4,007	1,944	1,465			27,348
Seventh Day Adventist	2,033			649	911	532			6,249
Unitarian	864			477	151	76			2,248
Protestant (undefined)	37,684			13,895	10,310	7,433	42	22	
Roman Catholic	382,740			53,467	58,449	29,576	454	634	
Greek Catholic	1,144		527	163	438	41			2,814
Catholic (undefined)	37,354			6.920	5,524	4,228	20	50	77,410
Others	9,252			2,852	1,796	2,211	6	ì	32,269
Total, Christian	1,624,846	1,297,695	593,917	404,611	272,115	190,151	1,541	1,708	4,386,584
NON-CHRISTIAN—									
Hebrew	7,864	6,470	700	807	1,860	136			17,837
Confucian	1,661	936		36	433	59	1,536		6,663
Mohammedan	1,036		867	569	1,947	12	48	1	4,971
Buddhist	582			32	2,293	127	36		4,187
Pagan	326	641	691	3	181	10	4		1,856
Others	2,987	1,090		211	326	50	83		7,115
Total, Non-Christian	14,456	9,690	7,683	1,658	7,040	394	1,707	1	42,629
INDEFINITE—								_	
Freethinker	1,070	825	678	237	466	95	8	1	3,380
Agnostic	1,010	1,009	521	197	398	65	7	1	3,208
No Denomination	573	1,208	254	303	275	151	2	]	2,766
Others	1,684	2,349	736	465	481	133	5	1	5,854
Total, Indefinite	4,337	5,391	2,189	1,202	1,620	444	22	3	15,208
NO RELIGION								-	
No Religion	2,806	2,560	1,894	1,022	1,248	210	40	2	9,782
Atheist	212	155	109	51	75	6			608
Others	77	60	21	14	16	6			194
Total, No Religion	3,095	2,775	2,024	1,087	1,339	222	40	2	10,584
GRAND TOTAL	1,646,734	1 315 551	605.813	408,558	282,114	191,211	3 310	1 714	4,455,005

The principal group in point of numbers is the Church of England, with a total of 1,755,473, the next in numerical order being the Roman Catholic Church. In connexion with this latter, there is reason to believe that a very large proportion, if not practically the whole of the persons who returned themselves simply as "Catholic," and who were in consequence tabulated under

# Distribution according to Religion, Commonwealth, 1911.



GRAPH No. 67.

the head of "Catholic (undefined)," belonged to the Roman Catholic Church. For many purposes these items may therefore be combined, thus giving a total for the Roman Catholic Church of 1,022,656. The third in numerical importance was the Presbyterian Church, with a total of 573,073, while the Methodist Church, with 561,550, ranked fourth. The four denominations specified thus accounted amongst them for about 88 per cent. of the total population. The only other heading to reach 100,000 was that of "Protestant (undefined)" of whom probably a large proportion should be credited to the Church of England, the Presbyterian and the Methodist Churches. Of the Non-Christian religions the Hebrew, with 17,837, was that most numerously represented.

Graph No. 67 furnishes for the Commonwealth as a whole for the sexes combined a representation of the number of adherents of the principal denominations and religions at the Census of 1911. The significance of the letters used in the graph is as follows:—A, Church of England; B, Presbyterian; C, Methodist; D, Baptist; E, Congregational; F, Lutheran; G, Church of Christ; H, Salvation Army; I, Protestant (undefined); J, Roman Catholic; K, Catholic (undefined); L, Non-Christian; M, Indefinite; N, No Religion. The

unit of scale shewn in the margin of the graph is 100,000 adherents, the Church of England adherents being represented by a double column to save space.

The proportion per cent. of the total population represented by the adherents of each denomination, sect, etc., is shewn in the succeeding table :—

Distribution per cent. of Population according to Religion, 1911.

			St	ATES.			TERRIT	ORIES.	
Religion.	N.S.W.	Vic.	Q'land.	S.A.	W.A	Tas.	N.T.	F.T.	C'wlth.
CHRISTIAN—	1 .								<del></del>
Church of England	45.45	35.15	36.25	29.22	40.05	47.72	20.48	39.96	39.40
Presbyterian	11.33	18.28	12.88	5.80	9.77	8.52	4.62	11.20	12.86
Methodist	9.32	13.71	10.16	25.66	12.51	13.46	3.66	7.06	12.61
Baptist Congregational	$1.27 \\ 1.40$	$\begin{array}{c} 2.42 \\ 1.28 \end{array}$	$\begin{bmatrix} 2.33 \\ 1.77 \end{bmatrix}$	5.58	$\frac{1.75}{2.26}$	$\frac{2.56}{2.63}$	.45		$\frac{2.24}{1.71}$
Congregational Lutheran	.44	.90	4.10	$\begin{array}{c} 3.41 \\ 6.80 \end{array}$	.91	.11	.76	.00	$1.71 \\ 1.67$
Church of Christ	.40	1.28	.44	2.38	1.02	.61	.03	.12	.89
Salvation Army	.46	.61	.73	.98	.69	• .77			.61
Seventh Day Adventist	.12	.11	.11	.16	.32	.28			.14
Unitarian	.05	.04	.03	.12	.05	.04	.03	1.00	.05
Protestant (undefined) Roman Catholic	$\begin{array}{c} 2.29 \\ 23.24 \end{array}$	$\frac{1.88}{21.17}$	$\frac{3.14}{23.35}$	$\frac{3.40}{13.09}$	$\begin{array}{c} 3.65 \\ 20.72 \end{array}$	$3.89 \\ 15.47$	$1.27 \\ 13.72$	$\frac{1.28}{36.99}$	$\begin{array}{c c} 2.54 \\ 21.22 \end{array}$
Greek Catholic	.07	.04	.09	.04	.15	.02	13.12		.06
Catholic (undefined)	2.27	1.14	1.36	1 69	1.96	2.21	.60	2.92	1.74
Others	.56	.63	1.30	.70	.64	1.15	.18	.06	.72
Total, Christian	98.67	98.64	98.04	99.03	96.45	99.44	46.56	99.65	98.46
/							İ		
NON-CHRISTIAN—			and the state of t					1	
Hebrew	.48	.49	.12	.20	.66	.07		1 ! • •	.40
Confucian	.10	.07	.33	.01	.15	.03	46.40		.15
Mohammedan	.06	.04	.14	.14	.69	.01	1 45	.06	.11
Buddhist	.04	.01	.17	.01	.81	.07	1.09	• • •	.10
Pagan Others	.02	.05 .08	.12	.05	.07 .11	$.01 \\ .02$	$\frac{.12}{2.51}$		.04 .16
Others ,.	.16	.00	.00	.00	.11	.02	2.01		,10
Total, Non-Christian	.88	.74	1.27	.41	2.49	.21	51.57	.06	.96
INDEFINITE—							<u>i</u>	i	
Freethinker	0.0	O.C.	.11	O.C.	17	05	94	0e	.08
Agnostic	.06	.06 .08	.09	.06 .05	.17	.05 .03	.24	.06 .06	.08
No Denomination	.04	.09	.04	.07	.10	.08	.06		.06
Others	.10	.18	.12	.11	.17	.07	.15	:05	.13
Total, Indefinite	.26	.41	.36	.29	.58	.23	.66	.17	.34
NO RELIGION—							ļ	<u> </u>	
N. D. P.	1			2=				3.0	
$egin{array}{lll} \mathbf{No} & \mathbf{Religion} & \dots & \dots \\ \mathbf{Atheist} & \dots & \dots & \dots \end{array}$	.17	.19	.31	.25	.44	.11	1.21	.12	.22
Others	.01	.01	.02	.01	.03	.01	[		.01
TOTAL, NO RELIGION	.19	.21	.33	.27	.48	.12	1.21	.12	.24
GRAND TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Amongst the States, the Church of England was proportionately most largely represented in Tasmania, New South Wales ranking second; the Roman Catholic Church, including "Catholic (undefined)" most largely in New South Wales, with Queensland second; the Presbyterian Church most largely in Victoria, with Queensland second; and the Methodist Church most largely in South Australia, with Victoria second. Of the other Christian Denominations the Baptist, Congregational, Lutheran, Church of Christ, Salvation Army and Unitarian were all proportionately more largely represented in South Australia than in any other State, while the

Seventh Day Adventists and the Greek Catholics were proportionately most largely represented in Western Australia. Of the Non-Christian religions, the Hebrew, the Mohammedan and the Buddhist, were proportionately most strongly represented in Western Australia, and the Confucian in Queensland.

The proportionate distribution of the adherents of the various religious denominations amongst the several States and Territories of the Commonwealth is shewn in the succeeding table:—

Percental Distribution of Adherents in States and Territories (sexes combined), 1911.

			ST	ÁTES.			TERRE	rories.	
Religion.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth.
CHRISTIAN—									
Church of England	42.64	26.34	12.51	6.80	6.43	5.20	.04	.04	100.00
Presbyterian		41.97	13.62	4.14	4.81	2.84	.03	.03	100.00
Methodist	• 27.34	32.11	10.97	18.67	6.29	4.58	.02	.02	100.00
Baptist	21.06	32.01	14.14	22.90	4.95	4.92	.02		100.00
Congregational	30.30	22.16	14.13	18.35	8.40	6.63	.03		100.00
Lutheran	9.63	15.98	33.34	37.31	3.44	.27	.03		100.00
Church of Christ		42.39	6.63	24.46	7.25	2.92			100.00
Salvation Army		29.14	16.20	14.65	7.11	5.36			100.00
Seventh Day Adventist Unitarian	32.53	23.59	10.40	10.39	14.58	8.51			100.00
Unitarian	38.44 33.30	$\begin{array}{c} 23.44 \\ 21.87 \end{array}$	$\begin{array}{c} 6.76 \\ 16.81 \end{array}$	$\begin{array}{c} 21.22 \\ 12.28 \end{array}$	$\frac{6.72}{9\cdot11}$	$\frac{3.38}{6.57}$	.04	.02	100.00
Roman Catholic	40.49	29.46	14.96	5.66	6.18	3.13	.05	.07	100.00
Greek Catholic	40.65	17.80	18.73	5.79	15.57	1.46			100.00
Catholic (undefined)	48.25	19.45	10.67	8.94	7.14	5.46	.03	.06	100.00
Others	28.67	25.62	24.43	8.84	5.57	6.85	.02		100.00
	·								
CHRISTIAN	37.04	29.58	13.54	9 22	6.20	4.34	.04	.04	100. 0
NON-CHRISTIAN									<u> </u>
Hebrew	44.09	36.27	3.93	4.52	10.43	.76			100.00
Confucian	24.93	14.05	30.05	.54	6.50	.88	23.05	::	100.00
Mohammedan	20.34	9.88	17.44	11.45	39.17	.24	.96	.02	100.00
Buddhist	13.90	1.48	25.20	.76	54.77	3.03	.86		100.00
Pagan	17.56	34.54	37.23	.16	9.75	.54	.22		100.00
Others	41.98	15.32	33.28	2.97	4.58	.70	1.17		100.00
Non-Christian	33.91	22.73	18.02	3.89	16.52	.92	4.01		100.00
INDEFINITE—							ļ		
TI	01.05	21.41	20.00	- 0.1	10.50	0.01	2.	0.0	10000
Freethinker	31.65	24.41	20.06	7.01	13.79	2.81	.24	.03	100.00
Agnostie	$\frac{31.48}{20.71}$	$31.45 \\ 43.67$	$16.24 \\ 9.18$	$\begin{array}{c} 6.14 \\ 10.95 \end{array}$	$\frac{12.41}{9.94}$	$\frac{2.03}{5.46}$	.22	.03	100.00 $100.00$
Others	28.77	40.13	12.57	7.94	8.22	$\frac{3.40}{2.27}$	.08	.02	100.00
Indefinite	28.52	35.45	14.39	7 90	10.65	2.92	.15	.02	100.00
NO RELIGION-									
No Religion	28.68	26.17	19.36	10.45	12.76	2.15	.41	.02	100.00
Atheist	34.87	25.49	17.93	8.39	12.33	.99			100.00
Others	39.69	30.93	10.82	7.22	8.25	3.09	• •	•••	100.00
No Religion	29.24	26.22	19.12	10.27	12.65	2.10	.38	.02	100.00
ALL RELIGIONS	36.96	29.53	13.60	9.17	6.33	4.29	.08	.04	100.00

In the case of most of the religions the largest number of adherents was naturally found in one or other of the two most populous States, viz., New South Wales and Victoria. Exceptions to this rule were in evidence in the case of Lutherans, which were most numerous in South Australia, Confucians in Queensland, and Mohammedans and Buddhists in Western Australia.

RELIGION.

The sex distribution of the adherents of the various denominations and sects in the several States and Territories of the Commonwealth is indicated in the succeeding table, which shews the excess of males over females per 100 of the sexes combined:—

Masculinity of Adherents, 1911 (Excess of Males over Females per 100 of sexes combined).

_			S	TATES.			TERRIT	TORIES.	
Religion.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
CHRISTIAN	!	5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
Church of England	4.29	.76	9.25	2.16	11.91	2.50	37.46	12.41	4.25
Presbyterian		.21	9.40	5.99	18.15	2.67	73.86	5.21	
Methodist		3.87	2.21	<b>—</b> 1.02	5.23	.78	14.05		
Baptist		8.93	- 1.78	4.94	5.13	6.98	86.67	٠.	- 5.18
Congregational		6.87	57	- 5.95	3.11	-3.50		100.00	,
Lutheran Church of Christ	$\frac{36.52}{-10.27}$	$-20.90 \\ -10.22$	8.68	6.99	48.93	46.53	36.00		14.18
Salvation Army		— 10.22 — 11.95	-5.02 $-3.77$	-10.60 $-5.96$	-4.30 $-1.85$	7.15 1.57	-100.00		
Seventh Day Adventist	-18.74	-22.93	-8.62	21.11	-4.06	-9.02			-6.76 $-15.98$
Unitarian	22.45	23.72	25.00	6.92	44.37	31.58	-100.00		21.3
Protestant (undefined)	16.23	11.75	19.66	10.76	25.00	13.57	47.62	9.09	
Roman Catholic	1.92	2.42	5.61	1.20	13.88	.55	47.58	20.50	
Greek Catholic	64.69	64 07	60.53	55.83	84.02	2.44			65.39
Catholic (undefined) Others	.13	3.29	10.03	6.50	13.90	6.62	30.00		
Others	.32	4.43	7.34	2.31	17.04	1.04	.00	100.00	1.98
CHRISTIAN	3.56	83	7.40	1.06	12.49	1.81	41.86	15.46	3.05
NON-CHRISTIAN					,				
Hebrew	7.07	3.62	24.86	4 50	19.07	10.01			
Confucian	99.40	99.15	96.30	$\begin{array}{c} \textbf{4.58} \\ \textbf{100.00} \end{array}$	$\begin{array}{c} 13.87 \\ 96.30 \end{array}$	$\begin{array}{c} 13.24 \\ 100.00 \end{array}$	05.01		7.16
Mohammedan	91.70	86.97	79.93	89.46	99.08	100.00	85.81	100.00	95.86 $91.7$
Buddhist	4	100.00	90.14	100.00	91.63	95.28	77.78		92.0
Pagan	100.00	99.69	97.11	33.33	85.64	100.00	100.00		97.3
Others	89.76	75.23	89.78	61.14	79.75	56.00	97.59	• •	86.09
Non-Christian	46.52	32.09	85.16	44.87	72.73	62.94	86.06	100.00	56.20
INDEFINITE—									
Freethinker	68.79	62.67	76.70	69.62	76.59	57.00	75.00	100.00	00 =
Agnostic		55.40	64.68	$\begin{array}{c} 69.62 \\ 62.44 \end{array}$	76.59 75.38	$57.90 \\ 66.15$		100.00 $100.00$	
No Denomination	17.28	15.73	30.71	16.83	18.55	9.93	100.00		17.57
Others	26.13	12.81	50.00	32.90	49.27	29.32		100.00	
Total, Indefinite	46.55	29.07	59.52	40.93	58.27	34.23	81.82	100.00	42.73
NO RELIGION—									
N. D. P.		_							1
No Religion	67.85	60.00	68.00	56 16	70.35	60.95	65.00	100.00	64.7
Atheist	81.13	70.32	77.98	84.31	86.67	100.00		٠.	78.95
Others	61.04	83.33	90.48	100.00	100.00	66.67		••	77.32
No Religion	68.59	61.08	68.77	58.05	71.62	62.16	65.00	100.00	65.82
ALL RELIGIONS	4.17	33	8.78	1.51	14.54	2.08	65.20	15.75	3.84

Note, - denotes excess of females.

For the Commonwealth as a whole there were six denominations in which there was a preponderance of females, these being the Methodist, the Baptist, the Congregational, the Church of Christ, the Salvation Army and the Seventh Day Adventist. This female preponderance was also in evidence in respect of these denominations in practically all the States, the principal exception being the Methodist denomination, which had a male preponderance in New South Wales, Queensland and Western Australia.

For the Commonwealth as a whole the largest preponderance of males amongst the Christian Denominations occurred in the case of the Greek Church, while the largest preponderance of females occurred in the case of the Seventh Day Adventists.

Amongst the Non-Christian religions males predominated throughout, the predominance being most marked amongst those returned as "Pagan," and least marked amongst the Hebrews.

6. Religion and Age.—Particulars as to age for each of the thirty classified items of religion were tabulated for each sex for each of the States and Territories in the five age groups—(i.) Under 5, (ii.) 5 and under 10, (iii.) 10 and under 15, (iv.) 15 and under 20, (v.) 20 and upwards. Full details will be found on pp. 772 to 825 of the Detailed Tables. As regards children it will be remembered that the instructions for filling in the personal cards provided for the insertion of the name of the religion "in which it is intended they shall be brought up."

The numbers in each age group, after adjustment for persons of unspecified ages and for the groups "object to state" and "unspecified" religion, were as follows for the Commonwealth as a whole:—

Religion and Age of Commonwealth Population (sexes combined), 1911.

D		. A	GE LAST BI	RTHDAY.		TT.	Pro- portion per cent
Religion.	Under 5.	5 to 9	10 to 14.	15 to 19.	20 and over	TOTAL.	aged 20 & over
CHRISTIAN							%
Church of England	217,095	181,218	167,668	177,290	1,012,202	1,755,473	57.66
Presbyterian	64,302	$55,\!463$	52,903	57,058	343,347	573,073	59.92
Methodist	70,530	62,315	59,938	62,513	306,254	561,550	
Baptist Congregational	10,998	10,062	9,892	10,504	58,099	99,555	58.36 60.34
Congregational	7,633 7,981	$7,289 \\ 6,982$	7,263 6,758	7,937 $7,244$	45,826 45,543	75,948 74,508	61 12
Church of Christ	4,687	4,165	4,123	4,789	21,968	39,732	55.29
Salvation Army	3,316	3,265	3,091	2,867	14,809	27,348	54.15
Seventh Day Adventist	683	720	732	672	3,442	6,249	55.08
Unitarian	97	94	73	113	1,871	2,248	83.23
Protestant (undefined)	11,741	9,740	9,004	9,846	72,830	113,161	64.36
Roman Catholic		98,572	94,103	95,742	545,318	945,246	57.69
Greek Catholic	$\begin{array}{c} 202 \\ 9,747 \end{array}$	$130 \\ 8,393$	130 7,805	302 8,239	$2,050 \\ 43,226$	$\frac{2,814}{77,410}$	72.85 55.84
Others	3,214	3,217	3,081	2,973	19,784	32,269	61.31
Citors	0,211	3,211	3,001	2,010	10,101	01,200	
Total, Christian	523,737	451,625	426,564	448,089	2,536,569	4,386,584	57.83
NON-CHRISTIAN—							-
TT-1	1 400	1 461	1 445	1.010	11 000	15.005	
Hebrew	$\frac{1,490}{75}$	1,401 77	$\begin{array}{c} 1,447 \\ 65 \end{array}$	1,616 47	11,883 6,399	$17,837 \\ 6,663$	66.62 96.04
Mohammedan	130	67	: 44	220	4,510	4,971	90.73
Buddhist	. 13	12		100	4,054	4,187	96.82
Pagan	12	$1\overline{1}$	10	16	1,807	1,856	97.36
Others	70	53	54	137	6,801	7,115	95.59
Total, Non-Christian	1,790	1,621	1,628	2,136	35,454	42,629	83.17
INDEFINITE—	i						-
Freethinker	92	47	54	134	3,053	3,380	90.33
Agnostic	86	56	• 63	90	2,913	3,208	90.80
No Denomination .	222	236	206	219	1,883	2,766	68.08
Others	378	323	318	345	4,490	5,854	76.70
TOTAL, INDEFINITE	778	662	641	788	12,339	15,208	81.13
NO RELIGION-							
No Religion	607		9.60	426	7 A 9 7	9,782	81.14
No Religion Atheist	8	444 6	368 4	420 23	$7,937 \\ 567$	9,782 608	93.26
Others	3	7		5	170	194	87.63
Total, No Religion	618	457	381	454	8,674	10,584	81.95
GRAND TOTAL	526,923	454,365	429,214	451,467	2,593,036	4,455,005	58.21

The denominations in which there were the largest proportions under the age of 20 were the Salvation Army (45.85 per cent.), the Methodist (45.46 per cent.), the Seventh Day Adventist (44.92 per cent.), and the Church of Christ (44.71 per cent.).

The proportion per cent. of the total population in each age group represented by the adherents of each denomination, sect, etc., is given in the following table:—

Distribution per cent. of Population in each Age Group according to Religion (sexes combined), 1911.

			AGE LAST	BIRTHDAY.		5
Religion.	Under 5.	5 to 9.	10 to 14.	15 to 19.	20 and over.	ALL AGES.
CHRISTIAN—		Ī		-		
Church of England	41.20	39.88	39.06	39.27	39.03	39.40
Presbyterian	12.20	12.21	12.33	12.64	13.24	12.86
Methodist		13.72	13.96	13.85	11.81	12.61
Baptist	2.09	2.21	2.30	2.33	2.24	2.24
Congregational Lutheran	1.45	1.60	1.69	$\begin{array}{c} 1.76 \\ 1.60 \end{array}$	$\substack{1.77\\1.76}$	$1.71 \\ 1.67$
Lutheran	1.51 .89	$\begin{array}{c} 1.54 \\ .92 \end{array}$	$\begin{array}{c} 1.57 \\ .96 \end{array}$	1.06	.85	.89
Salvation Army	.63	.72	.72	.63	.57	.61
Seventh Day Adventist	.13	.16	.17	.15	.13	.14
Unitarian	.02	.02	.02	.02	.07	.05
Protestant (undefined)	2.23	2.14	2.10	2.18	2.81	2.54
Roman Catholic	21.16	21.69	21.93	21.21	21.03	21.22
Greek Catholic	.04	.03	.03	.07	.08	.06 1.74
Catholic (undefined)	1.85	1.85	1.82	1.82 .66	$\substack{1.67\\.76}$	.72
Others	.61	.71	.72	.00	.10	
Total, Christian	99.39	99.40	99.38	99.25	97.82	98.46
ION-CHRISTIAN—						:
Hebrew	.28	.31	.34	.36	.46	.40
Confucian	.01	.02	.02	.01	.25	.15
Mohammedan		.01	٠٠ <b>-</b>	.05	.17	.11
Buddhist	1		.01	.02	.16	.10
Pagan	.01	.01	: J		.07	.04
Others	.01	.01	.01	.03	.26	.16
Total, Non-Christian	.34	.36	.38	.47	1.37	.96
NDEFINITE	<u> </u>		-			
					10	.08
Freethinker	.02	.01	.01	.03	$.12 \\ .11$	.07
Agnostic No Denomination	$.02 \\ .04$	.01	.02	$.02 \\ .05$	.08	.06
No Denomination Others	.07	.07	.07	.08	.17	.13
Total, Indefinite	.15	.14	.15	.18	.48	.34
•	-					
NO RELIGION-						
No Religion	.12	.10	.08	.09	.31	.29
Atheist			.01	01	.02	.01
Others	• •		J		<u> </u>	.01
Total, No Religion	.12	.10	.09	.10	.33	.24
GRAND TOTAL	100.00	100.00	100.00	100.00	100.00	100.00

Of the four leading denominations the Church of England, the Roman Catholic and the Methodist were proportionately more largely represented amongst the population under 20 years of age than amongst that aged 20 years and upwards, the difference being relatively small in all instances, but more marked in that of the Methodist Church than in the other cases. The Presbyterian Church on the other hand was proportionately somewhat more strongly represented amongst the population aged 20 and upwards than amongst those under 20 years of age. All the Non-Christian Religions were proportionately more largely represented amongst those over than amongst those under 20 years of age, the disparity being least marked in the case of the Hebrews.

The sex distribution of the adherents of the various denominations and sects in each age group is indicated in the succeeding table, which shews the excess of males over females per 100 of the sexes combined:—

Masculinity of Adherents in Age Groups, 1911 (Excess of Males over Females per 100 of sexes combined).

		A	GE LAST BIRT	CHDAY.		
Religion.	Under 5.	5 to 9.	10 to 14.	15 to 19.	20 and over.	ALL AGES
CHRISTIAN—	•					.!
Church of England	1.99	1.21	1.21	1.86	6.20	4.25
Presbyterian	1.60	2.05	1.55	1.57	6.45	4.54
Methodist	1.81	2.15	.01	56	_ 2.23	81
Baptist	1.98	30	79	<b>4.19</b>	- 8.25	5.15
Congregational	.04	1.30	1.12	- 1.80	- 5.84	- 3.69
Lutheran	1.77	.57	-1.24	4.31	22.30	14.18
Church of Christ	.06	.12	4.39	12.47	<b>— 13.60</b>	9.46
Salvation Army	.54	1.75	3.40	16 71	9.04	6.76
Seventh Day Adventist	3.07	.56	-6.01	15.18	-25.45	15.95
Unitarian Protestant (undefined)	3.09	12.77	28.77	-2.65	23.89	21.35
Roman Catholic	1.73	.74	4.11	10.48	22.23	15.79
Greek Catholic	$\begin{array}{c} 1.25 \\ 5.94 \end{array}$	.72	.65	.51	2.68	1.88
Catholic (undefined)	1.51	$\begin{array}{c} 10.77 \\ .32 \end{array}$	18.46	78.15	75.80	65.39
Others	$\begin{array}{c} 1.31 \\ 6.72 \end{array}$	3.89	$12 \\ 3.47$	-4.00	5.17	3.73
,	0.72	J.69	0.47	- 4.00	1.57	1.98
CHRISTIAN	1.72	1.29	.80	1.00	4.37	3.05
ION-CHRISTIAN-				<del>-</del>		
Hober-				i.		1
Hebrew	1.61	3.21	-4.63	3.59	10.24	7.16
M-1 1	17.33	6.49	41.54	65.96	97.84	95.86
D 1111	1.54	10.45	31.82	80.91	96.94	91.71
Pagan	7.69	16.67	.00	96.00	92.65	92.07
Others	.00 2.86	63.64 39.62	$\begin{array}{c} \textbf{40.00} \\ \textbf{22.22} \end{array}$	$\begin{array}{c} 87.50 \\ 59.12 \end{array}$	$98.56 \\ 88.41$	97.31 86.09
Non-Christian	2.12	4.50	61	21.44	66.00	56.20
NDEFINITE						-
Freethinker	23.91	27.66	44.44	34.33	73.73	69 70
Agnostic	13.95	3.57	14.29	15.56	71.23	65.84
No Denomination	5.41	3.39	9.71	3.20	25.44	17.57
Others	10.05	93	1.89	-5.51	34.16	26.38
Indefinite	10.80	3,02	1.09	6.09	51.37	42.73
O RELIGION—		THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE S	_		<del></del>	
No Religion	17.30	12.61	17.93	39.44	74.85	64.77
Atheist	.00	33.33	50.00	47.83	83.42	78.95
Others	33.33	<b>— 14.29</b>	55.56	60.00	84.71	77.32
No Religion	16.83	11.60	18.11	40.09	75.61	65.82
All Religions	1.55	1.03				
ALL RELIGIONS	1.75	1.31	.81	1.15	5.68	3.84

Note, — denotes excess of females.

<sup>7.</sup> Religion and Education.—Particulars as to education in conjunction with religion were tabulated under each of the thirty classified items of religion for each sex for each State and Territory under the five heads (i.) read and write English, (ii.) read only (English), (iii.) read and write foreign language only, (iv.) read only (foreign language only), (v.) cannot read. Full details will be found on pp. 772 to 825 of the Detailed Tables.

After adjustment to allow for those whose degree of education was unspecified, as well as for the groups "object to state," and "unspecified" religion, the particulars for the Commonwealth as a whole for the sexes combined were as follows:—

Religion and Education of Commonwealth Population (sexes combined), 1911.

•	Engl Langu		Form Langua	EIGN GE ONLY.	Canno	T READ.		tion per aged 5 upwards to read.
RELIGION.	Read and Write.	Read only.	Read and Write.	Read only.	Under 5 Years of Age.	Aged 5 Years and upwards.	TOTAL.	Proportion per cent. aged 5 years & upwards unable to read.
CHRISTIAN—			!					%
Church of England Presbyterian	1,475,501 494,198	$5,129 \\ 1,432$	1,539 393	175	217,095 64,302	56,934 $12,703$	1,755,473 573,073	3.64 2.50
Methodist	473,549	1,827	420	43	70,530	15,181	561,550	3.09
Baptist	85,572	325	200	33	10,998	2,427	99,555	2.74
Congregational	66,340	186	43	4	7,633	1,742	75,948	2.58
Lutheran	58,586	441	4,721	494	7,981	2,285	74,508	3.43
Church of Christ	33,858	. 116	94		4,687	970	39,732	2.77
Salvation Army	22,711	175	28	6	3,316	1,112	27,348	4.63
Seventh Day Adventist Unitarian	5,339	16	15	2	683	$\begin{array}{c} 194 \\ 24 \end{array}$	$6,249 \\ 2,248$	3.49 1.12
Protestant (undefined)	2,114 $97,156$	6 $352$	934	$^{\cdot\cdot\cdot}$ 24	97 $11,741$	2.954	113,161	2.9
Roman Catholic	788,024	4,806	4,707	410	111,511	35,788	945,246	4.29
Greek Catholic	1,307	26	965	67	202	247	2,814	9.46
Catholic (undefined)	63,091	360	810	53	9,747	3,349	77,410	4.9
Others	27,175	108	823	67	3,214	882	32,269	3.04
Total, Christian	3,694,521	15,305	15,699	1,430	523,737	135,892	4,386,584	3.52
NON-CHRISTIAN—								
Hebrew	15,262	76	500	64	1,490	445	17,837	2.72
Confucian	608	9	4,276	233	75	1,462	6,663	22.19
Mohammedan	690	19	1,607	240	130	2,285	4,971	47.20
Buddhist	603	3	2,700	281	13	587	4,187	14.06
Pagan	$\begin{array}{c} 224 \\ 1,617 \end{array}$	28 16	725 4,070	$\frac{497}{259}$	$\begin{array}{ c c }\hline & 12\\ 70 \end{array}$	370 1,083	1,856 7,115	20.07 $15.37$
Ovnors	1,017	. 10	4,070	209		1,003	7,119	13.57
Total, Non-Christian	19,004	151	13,878	1,574	1,790	6,232	42,629	15.26
INDEFINITE—				············				,
Freethinker	3,211	6	31	1	92	39	3,380	1.19
Agnostic	3,056	10	15	27	86	14	3,208	.43
No Denomination	2,487	2	4		222	51	2,766	2.00
Others	5,235	23	85	12	378	121	5,854	2.21
Total, Indefinite	13,989	41	135	40	778	225	15,208	1.56
NO RELIGION-								
No Religion	7,932	26	315	31	607	871	9,782	9.49
Atheist	556	1	32		8	11	608	1.83
Others	188	• •			3	1	194	.52
Total, No Religion	8,676	27	349	31	618	883	10,584	8.86
Grand Total	3,736,190	15,524	30,061	3,075	526,923	143,232	4,455,005	3.65

The headings which furnished the smallest proportion above the age of 5 unable to read were "Agnostic" (0.45 per cent.), "Others, No Religion" (0.52 per cent.), "Unitarian" (1.12 per cent.), "Freethinker" (1.19 per cent.), and "Atheist" (1.83 per cent.). For the four leading Christian denominations the corresponding proportions were "Presbyterian" (2.50 per cent.), "Methodist" (3.09 per cent.), "Church of England" (3.64 per cent.), and

"Roman Catholic" (4.29 per cent.). Amongst the Non-Christian religions the proportion above the age of 5 unable to read was large in all cases except that of the Hebrews, for whom a percentage of 2.72 was recorded.

8. Religion and Conjugal Condition.—The Conjugal Condition of the adherents of the various Religions and denominations were tabulated for each sex for each State and Territory, and full details relative thereto will be found on pp. 772 to 825 of the Detailed Tables.

details relative thereto will be found on pp. 772 to 825 of the Detailed Tables.

After adjustment to allow for those whose Conjugal Condition was not stated, and for those contained in the groups "object to state" and "unspecified" religion, the particulars for the Commonwealth as a whole for the sexes combined, are as follows:—

Religion and Conjugal Condition of Commonwealth Population (sexes combined), 1911.

	:	NEVER I	Married.				
Religion.	MARRIED.	Under 15 years of Age.	Aged 15 years & over.		DIVORCED.	Total.	
CHRISTIAN_	1	§				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Church of England	595,905	565,981	517,771	73,605	2,211	1,755,473	
Presbyterian	191,962	172,668	182,846	25,116	481	573,073	
Methodist		192,783	158,228	20,732	288	561,550	
Baptist	35,465	30,952	28,494	4,573	71	99,555	
Congregational	26,298	22,185	23,876	3,544	45	75,948	
Lutheran	26,857	21,721	22,234	3,633	63	74,508	
Church of Christ	13,756	12,975	11,393	1,584	24	39,732	
Salvation Army	$9,228 \\ 2,097$	$9,672 \\ 2,135$	7,170	1,260	18 7	27,348	
Seventh Day Adventist Unitarian	1,029	$\begin{array}{c} 2,135 \\ 264 \end{array}$	$\substack{\textbf{1,665}\\\textbf{742}}$	$\frac{345}{207}$	6	6,249 $2,248$	
Protestant (undefined)	42,551	30,485	34,479	5,443	203	113,16	
Roman Catholic	274,652	304,186	321,502	44,118	788	945,246	
Greek Catholic	825	462	1,461	61	5	2,814	
Catholic (undefined)	24,868	25,945	23,393	3,125	79	77,410	
Others	11,925	9,512	9,108	1,682	42	32,269	
Total, Christian	1,446,937	1,401,926	1,344,362	189,028	4,331	4,386,584	
ON-CHRISTIAN—		<u> </u>					
					'		
Hebrew	6,991	4,338	5,602	841	65	17,83	
Confucian	2,281	217	4,078	86	1	6,66	
Mohammedan	1,271	241	3,259	186	14	4,97	
Buddhist	805	33	3,292	51	6	4,18	
Pagan	704	33	1,079	38	$\frac{2}{4}$	1,856	
Others	2,424	177	4,278	232	4	7,118	
Total, Non-Christian	14,476	5,039	21,588	1,434	92	42,629	
NDEFINITE		i					
Freethinker	1,380	193	1,573	216	18	3,380	
Agnostic	1,471	205	1,332	189	11	3,380 3,208	
No Denomination	1,074	664	904	121	3	2,766	
Others	2,519	1,019	1,826	471	19	5,854	
Total, Indefinite	6,444	2,081	5,635	997	51	15,208	
O RELIGION—							
			1		1		
No Religion	3,691	1,419	4,197	443	32	9,78	
Atheist	224	18	329	35	2	608	
Others	92	19	69	14	•••	194	
TOTAL, No RELIGION	4,007	1,456	4,595	492	34	10,58	
	<u> </u>	<u> </u>	<u> </u>	<u></u>		<u> </u>	
GRAND TOTAL	1,471,864	1,410,502	1,376,180	191,951	4,508	4,455,00	

RELIGION. 209

In the following table is given for each religion or denomination the proportion per cent. of its total adherents aged 15 and upwards belonging to each of the four conjugal condition divisions. At the Census 3 males and 19 females under the age of 15 were recorded as married, whilst all the rest of the population below that age were recorded as never married. For the sake of convenience in review and analysis these 22 persons have in the preceding table and the two succeeding tables been treated as being aged 15. The error so introduced is quite insignificant.

Distribution per cent. of Adherents aged 15 and upwards, according to Conjugal Condition (sexes combined), 1911.

Religion.	Married.	Never Married.	Widowed.	Divorced.	Total
CHRISTIAN—	%	%	%	%	0/ /0
Church of England	50.10	43.53	6.19	.18	100.00
Church of England Presbyterian	$\begin{array}{c} 30.10 \\ 47.94 \end{array}$	45.67	6.27	.12	100.00
Methodist	51.39	42.91	5.62	.08	100.00
Baptist	51.70	41.53	6.67	.10	100.00
Congregational	48.92	44.41	6.59	.08	100.00
Lutheran	50.88	42.12	6.88	.12	100.00
Church of Christ	51.41	42.58	5.92	.09	100.00
Salvation Army	52.21	40.56	7.13	.10	100.00
Seventh Day Adventist	50.97	40.47	8.39	.17	100.00
TT. 1	51.87	37.40	10.43	.30	100.00
Protestant (undefined)	51.47	41.70	6.58	.25	100.00
_ ~ ~ /	42.85	50.15	6.88	.12	100.00
		62.12	2.59	.21	100.00
Greek Catholic	35.08		6.07	.15	100.00
Catholic (undefined)	48.32	45.46		.19	100.00
Others	$52.4$ $^\circ$	40.02	7.39	.19	
Christian	48.48	45.04	6.33	.15	100.00
NON-CHRISTIAN-					
Hobson	51.79	41.50	6.23	.48	100.00
Hebrew		63.26	1.33	.02	100.00
Confucian	35.39		3.93	.30	100.00
Mohammedan	26.87	68.90	1.23	.14	100.00
Buddhist	19.38	79.25			100.00
Pagan	38.62	59.19	2.08	.11	100.00
Others	34.94	61.66	3.34	.06	100.00
Non-Christian	38.51	57.43	3.82	.24	100.00
INDEFINITE—	<del></del>				<del></del> -
TS - (1 ! 1 -	49.00	40.26	6.78	.56	100.00
Freethinker	43.30	49.36	6.29	.37	100.00
Agnostic	48.98	44.36	5.76	.14	100.00
No Denomination	51.09	43.01	9.74	.39	100.00
Others	52.10	37.77	9.74		
Indefinite	49.09	42.93	7.59	.39	100.00
NO RELIGION—					
N. D. Bailer	44.10	E0 10	5.30	.38	100.00
No Religion	44.13	50.19		.34	100.00
Atheist	37.97	55.76	5.93	1	100.00
Others	52.57	39.43	8.00	••	100.00
No Religion	43.90	50.34	5.39	.37	100.00
	48.35	45.20	6.30	.15	100.00

Of the four leading denominations the Methodist Church had the highest proportion of married persons and the lowest proportion of persons never married, widowed, or divorced. The Roman Catholic Church had the lowest proportion married, and the highest proportion never married or widowed. The Church of England had the highest proportion of divorced persons, while the Presbyterian Church occupied in all cases a position between highest and

lowest. Taking all religions into account, the largest proportions of divorced persons were found amongst the freethinkers (0.56 per cent.), and the Hebrews (0.48 per cent.), while the largest proportion amongst Christian denominations occurred in the case of the Unitarians.

The sex-distribution of the adherents of the various religions and denominations of each conjugal condition is indicated in the succeeding table, which shews the excess of males over females per 100 of the sexes combined:—

Masculinity of Adherents according to Conjugal Condition, 1911 (Excess of males over females per 100 of sexes combined).

		Never 1	MARRIED.			
Religion.	MARRIED.	Under 15 years of age.	Aged 15 years and over.	WIDOWED.	DIVORCED.	Total.
HRISTIAN-						
Church of England	.43	1.51	16.75	31.50	05	4.25
Presbyterian	3.14	1.73	13.73	-32.39	5.20	4.54
Methodist	- 2.59	1.36	4.45	-44.84	- 6.94	81
Baptist	- 4.30	.36	5.34	-47.65	12.68	- 5.15
Congregational	.51	.08	- 5.98	-42.89	- 6.67	<b>— 3.6</b> 9
Lutheran	13.00	.45	34.07	17.37	49.21	14.18
Church of Christ	- 9.87	1.33	11.54	56.82	50.00	-9.46
Salvation Army	-5.37	<b>—</b> .31	10.21	-46.35	- 33.33	-6.76
Seventh Day Adventist	-21.32	89	<b>— 18.56</b>	65.22	42.86	15.95
Unitarian	31.39	13.64	16.44		66.67	21.35
Protestant (undefined)	12.62	2.12	35.39	7.66	33.99	15.79
Roman Catholic	6.13	.89	15.00	-37.11	8.12	1.88
Greek Catholic	47.15	10.82		44.26	100.00	65.39
Catholic (undefined) Others	-6.98 $5.19$	$\begin{array}{c} .64 \\ 4.71 \end{array}$	23.88	-35.55 $-33.29$	$-24.05 \\ 42.86$	3.73
Others	5.19	4.71	1.25	33.29	42.80	1.98
Christian	58	1.30	14.04	34.44	3.44	3.05
ION-CHRISTIAN						
TT-1.	0.00	0.5	15.40	01.00	10.05	- 10
Hebrew	9.83	.05	15.46	31.99	-13.85	7.16
Confucian	93.77	20.74	99.85	93.02	100.00	95.86
Mohammedan Buddhist	87.57 76.15	3.73 9.09	99.45	$97.85 \\ 92.16$	$100.00 \\ 66.67$	91.71
70	97.16	33.33	96.84 99.63	92.16 89.47	100.00	$92.07 \\ 97.31$
Pagan Others	83.33	17.51	91.87	62.07	.00	86.09
	30.00	11.61	01.01	02.01	.00	
Non-Christian	50.12	2.00	75.84	15.20	13.04	56.20
NDEFINITE—						
77 () ' I	20.55					 
Freethinker	63.77	30.57	79.78	67.59	88.89	69.70
Agnostic No Denomination	64.65 28.86	11.22	$74.77 \\ 17.92$	69.31	100.00	65.84
No Denomination Others	29.81	2.85		$9.09 \\1.49$	$100.00 \\ 57.89$	$17.57 \\ 26.38$
Outers	23.01	2.65	41.02	1.49	91.69	20.30
Indefinite	44.88	5.33	56.31	28.18	80.39	42.73
NO RELIGION—		-				
No Religion	64.24	16.00	80.70	73.81	75.00	64.77
Atheist	74.11	-22.22	87.23	82.86	100.00	78.95
Others	80.43	15.79		57.14		77.32
No Religion	65.16	15.52	81.37	73.98	76.47	65.82
Arr Barraraya	90	1 90	18 41	99 40	5.00	9.04
ALL RELIGIONS	.30	1.32	15.41	33.46	5.06	3.84

<sup>9.</sup> Comparison with Previous Censuses.—Owing to differences in range and nature of the tabulation of the data for religion at previous Censuses a complete comparison with the results of the present Census cannot be made. The data available are, however, sufficient to admit of a comparison under the leading heads. Such a comparison is furnished in the succeeding table:—

Commonwealth Population according to Religion (sexes combined), 1891, 1901 and 1911.

Religion.	Number	of Adhe	rents.		rtion pe al Popu		(exces	nity of Ac s of Male s per 100 o combined	es over of sexes
	1891.	1901.	1911.	1891.	1901.	1911.	1891.	1901.	1911.
CHRISTIAN—									
Church of England	1,258,857	1,520,229	1,755,473	39.66	40.28	39.40	7.47	5.08	4.25
Presbyterian	358,937		573,073	11.31	11.46	12.86	6.96	4.46	4.54
Methodist	405,168				13.56	12.61	.96	.28	81
Baptist	73,685			2.32	2.40	2.24	2.29	4.04	- 5.15
Congregational	74,140 72,281		75,948 74,508	$\frac{2.34}{2.28}$	$\frac{1.98}{2.02}$	$\begin{array}{c} 1.71 \\ 1.67 \end{array}$	$\begin{array}{c c} & .31 \\ \hline 18.51 \end{array}$	$ \begin{array}{c c} 2.75 \\ 15.95 \end{array}$	3.69 $14.18$
Church of Christ	15,130	$76,193 \\ 24,545$		.48	.65	.89	3.45	-6.42	-9.46
Salvation Army	34,088		27,348	1.07	.84	.61	1.04	<b>— 4.36</b>	6.76
Seventh Day Adventist	726		6,249	.02	.09	.14	-5.23	14.89	15.95
Unitarian	3,971	2,671	2,248	.12	.07	.05	29 09	23.70	21.35
Protestant (undefined)	30,476		113,161	.96	.55	2.54	17.12	12.18	15.79
Roman Catholic	719,354		945,246		22.88	21.22	3.64	2.38	1.88
Greek Catholic	637	1,337	2,814	.02	.03	.06	79.91	63.95	$65.39 \\ 3.73$
Catholic (undefined) Others	8,607 19,787	5,258 $22,148$	77,410 $32,269$	.62	$.14\\.59$	$\begin{array}{c} 1.74 \\ .72 \end{array}$	$\frac{3.61}{6.18}$	$\begin{array}{c} 6.58 \\ .75 \end{array}$	1.98
Others	19,767	22,140	32,209	.02	.55		0.16		
Total, Christian	3,075,844	3,681,028	4,386,584	96.89	97.54	98.46	5.50	3.42	3.05
NON-CHRISTIAN—									
Hebrew	14,084	15,471	17,837	.45	.41	.40	11.09	7.25	7.16
Confucian	12,002	10,1,1	6,663			.15		0	95.86
Mohammedan	43,810	26 252	4 071		.96	.11	} 93.80	94.70	91.71
Buddhist	45,610	36,353	1 4,101		.90	10	93.80	94.70	92.07
Pagan		0 500	1,856		07	.04	00.10	45.00	97.31
Others	380	2,508	7,115	.01	.07	.16	63.16	45.06	86.09
Total, Non-Christian	58,274	54,332	42,629	1.84	1.44	.96	73.61	67.50	56.20
INDEFINITE—									·····
Freethinker	15,838	9,350	3,380	.50	.25	.08	62.41	71.49	69.70
Agnostic	882			.03	.03	.07	69.16	72.06	65.84
No Denomination	13,520	20,086		.42	.53	.06	42.62	38.27	17.57
Others	1,767	1,118	5,854	.06	.03	.13	25.07	16.28	26.38
Total, Indefinite	32,007	31,542	15,208	1.01	.84	.34	52.17	48.39	42.73
NO RELIGION—									
No Religion	7,230	6,597	9,782	.23	.17	.22	60.11	59.16	64.77
Atheist	804				.01	.01	46.27	79.21	78.95
Others	233			J .03	.01	[ .01	48.50	65.22	77.32
TOTAL, NO RELIGION	8,267	6,899	10,584	.26	¿18	.24	58.44	59.99	65.82
Grand Total	3,174,392	3,773,801	4,455,005	100 00	100.00	100.00	7.36	4.82	3.84

Owing to the comparative largeness of the items "Protestant (undefined)" and "Catholic (undefined)" in 1911 as compared with 1891 and 1901, it is difficult to make a satisfactory comparison of the relative growth of the leading denominations. Assuming that the persons appearing under the head of "Protestant (undefined)" may be equitably distributed proportionately over the denominations appearing above that heading in the preceding table, and that those appearing as "Catholic (undefined)" may be classed as "Roman Catholic," it appears that the adherents of the Church of England represented 40.19 per cent. of the total population in 1891, 40.53 per cent. in 1901, and 40.78 per cent. in 1911. Similarly the Roman Catholic represented 22.93 per cent. in 1891, 23.02 per cent. in 1901 and 22.96 per cent. in 1911; while Presbyterians represented 11.46 per cent., 11.55 per cent., and 13.31 per cent., and Methodists 12.93 per cent., 13.66 per cent., and 13.05 per cent. respectively at the last three Censuses.

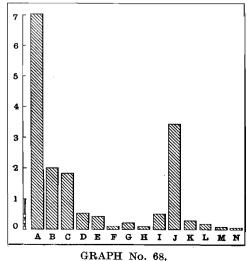
10. Religions of Metropolitan Population.—In the following table are given particulars respecting the religions of the residents of metropolitan areas in the several States.

Metropolitan Population according to Religion (sexes combined), 1911.

Religion.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan.
CHRISTIAN—							
Church of England	295,000	223,905	51,197	67,013	43,873	20,042	701,030
Presbyterian	64,035	91,413	18,369	9,776	11,576	3,308	198,477
Methodist	43,772	65,948	15,342	39,918	12,404	3,490	180,874
Baptist	9,447	20,168	5,688	14,430	2,159	668	52,560
Congregational	15,750	10,606	3,527	7,859	3,999	1,395	43,136
Lutheran	1,880	2,720	2,895	2,697	809	53	11,054
Church of Christ	3,702	9,857	552	6,470	1,576	274	22,431
Salvation Army	2,116	3,918	905	1,599	773	216	9,527
Seventh Day Adventist	557	676	107	275	303	191	2,109
Unitarian	644	371	54	363	80	41	1,553
Protestant (undefined)	19,113	13,664	4,669	7,173	3,627	2,752	50,998
Roman Catholic	140,139	120,946	30,796	25,245	19,826	6,158	343,110
Greek Catholic	515	403	124	83	199	10	1,334
Catholic (undefined)	14,940	7,009	1,257	2,868	1,880	614	28,568
Others	4,975	4,994	2,294	1,848	914	458	15,483
Total, Christian	616,585	576,598	137,776	187,617	103,998	39,670	1,662,244
NON-CHRISTIAN—							
Hebrew	6,491	5,717	393	747	1,349	89	14,786
Confucian	721	602	117	4	206	5	1,655
Mohammedan	94	58	47	22	57		278
Buddhist	244	23	24	. 9	160	2	462
Pagan	88	422	19	2	12	7	550
Others	1,212	470	198	117	73	4	2,074
Total, Non-Christian	8,850	7,292	798	901	1,857	107	19,805
INDEFINITE			-				
Freethinker	453	418	93	105	118	21	1,208
Agnostic	639	701	147	115	134	. 28	1,764
No Denomination	281	660	88	111	129	24	1,293
Others	1,053	1,700	186	252	200	39	3,430
TOTAL, INDEFINITE	2,426	3,479	514	583	581	112	7,695
NO RELIGION—			<del></del>			<u> </u>	<del></del>
No Religion	1,487	1,483	358	515	337	47	4,227
Atheist	118	91	25	23	14	i	272
Others	37	28	9	7	5		86
TOTAL, NO RELIGION	1,642	1,602	392	545	356	48	4,585
GRAND TOTAL	629,503	588,971	139,480	189,646	106,792	39,937	1,694,329

Church of England, Roman Catholic, Congregational, and Hebrew adherents were more numerous in Sydney than in any other of the capitals, while Presbyterian, Methodist, Baptist, Church of Christ, and Salvation Army adherents were most numerously represented in Melbourne.

Distribution according to Religion-Metropolitan areas, 1911.



In the accompanying graph (No. 68) is furnished a representation for the metropolitan areas of the Commonwealth of the number of adherents of both sexes combined of the various religious denominations, etc. The various religious denominations, etc. The denominations, etc., denoted by the several letters on the graph are as follows:—A, Church of England; B, Presbyterian; C, Methodist; D, Baptist; E, Congregational; F, Lutheran; G, Church of Christ; H, Salvation Army; I, Protestant (undefined); J, Roman Catholic; K, Catholic (undefined); L, Non-Christian; K, Catholic (undefined); L, Non-Christian; M, Indefinite; N, No Religion. The unit of the scale shewn in the margin of the margin of the graph is 100,000 adherents.

The proportion per cent. of the total population of each metropolitan area represented by the adherents of each denomination and sect is shewn in the following table:-

Distribution per cent. of Metropolitan Population according to Religion (sexes combined), 1911.

RELIGION.	Sydney and Suburbs	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan.
CHRISTIAN—					-		
Church of England	46.86	38.02	36.70	35.34	41.08	50.18	41.38
Presbyterian	10.17	15.52	13.17	5.16	10.84	8.28	11.72
Methodist	6.96	11.20	11.00	21.05	11.61	8.74	10.68
Baptist	1.50	3.42	4.08	7.61	2.02	1.67	3.10
Congregational	2.50	1.80	2.53	4.14	3.75	3.49	2.55
Lutheran	.30	.46	2.07	1.42	.76	.13	.65
Church of Christ	.59	1.67	.40	3.41	1.48	.69	1.32
Salvation Army	.34	.67	.65	.84	.72	.54	.56 $.12$
Seventh Day Adventist	.10	.11	.08	.15 .19	.28	.48	.09
Unitarian	3.04	2.32	$\begin{array}{c} .04 \\ 3.35 \end{array}$	3:78	3.40	6.89	3.01
Roman Catholic	22.26	20.54	22.08	13.31	18.56	15.42	20.25
Greek Catholic	.08	.07	.09	.04	.19	.03	.08
Catholic (undefined)	2.37	1.19	.90	1.51	1.76	1.54	1.69
Others	.79	.85	1.64	.98	.86	1.15	.91
Total, Christian	97.95	97.90	98.78	98.93	97.38	99.33	98.11
NON-CHRISTIAN—							
Hobers	1.03	.97	.28	.39	1.26	.22	.87
Hebrew	.12	.10	.09	.59	.19	.01	.10
	.02	.01	.03	<u> </u>	.06	.01	.02
Mohammedan Buddhist	.04	.01	.02	.02	315	.01	.03
Pagan	.01	.07	.01	IJ	.01	.02	.03
Others	.19	.08	.14	.06	.07	.01	.12
Total, Non-Christian	1.41	1.24	.57	.47	1.74	27	1.17
INDEFINITE—		-			1		
Freethinker	.07	.07	.07	.06	.11	.05	.07
Agnostic	.10	.12	.11	.06	.13	.07	.10
No Denomination	.04	.11	.06	.06	.12	.06	.08
Others	.17	.29	.13	.13	.19	.10	.20
Total, Indefinite	.38	.59	.37	.31	.55	.28	.45
NO RELIGION—					ļ.		
No Religion	.24	.25	.26	.27	.31	.12	.25
Atheist		.01	1				
Others	.02	01	.02	.02	.02	••	.02
Total, No Religion	.26	.27	.28	.29	.33	.12	.2'
GRAND TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.0

Of the four principal denominations the Church of England was proportionately most largely represented in Hobart, Sydney ranking second; the Roman Catholic (including "Catholic undefined") in Sydney, with Brisbane second; the Presbyterian in Melbourne, with Brisbane second, and the Methodist in Adelaide, with Perth second. Of the other Christian denominations the Baptist, the Congregational, the Church of Christ, the Salvation Army, and the Unitarian were proportionately most largely represented in Adelaide; the Seventh Day Adventist and the Greek Catholic in Perth, and the Lutheran in Brisbane.

Of the Non-Christian religions, the Hebrew, the Confucian, the Mohammedan, and the Buddhist were all proportionately more largely represented in Perth than in any other of the capitals.

The sex distribution of the adherents of the various religions and denominations in each of the Metropolitan areas is indicated in the succeeding table, which shews the excess of males over females per 100 of the sexes combined.

Masculinity of Adherents in Metropolitan Areas, 1911 (Excess of males over females per 100 of sexes combined).

Religion.	Sydney and Suburbs	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	All Metro- politan.
CHRISTIAN—			 				
Church of England	2.96	   4.64	_ 2.01	- 3.28	61	_ 8.62	- 3.47
Presbyterian		- 5.68	2.03	.68	2.56	5.20	- 3.03
Methodist	<b>4.92</b>	$\begin{array}{c c} - & 7.93 \\ - & 11.31 \end{array}$	_ 5.20	- 6.13	4.00	-7.16	- 6.29
Baptist	9.66	11.31	8.44	- 8.37	-2.27	-17.96	-9.61
Congregational	- 6.21	9.15	-7.85	10.50	-2.78	-12.83	- 7.74
Lutheran Church of Christ	48.09	25.66 11.66	2.52	$3.60 \\ -12.74$	$24.60 \\8.63$	$24.53 \\ 19.71$	17.95 $12.24$
Church of Christ Salvation Army	-13.72 $-7.66$	-11.00 $-19.19$	$-13.41 \\ -16.24$	-12.74 $-14.32$	9.44	-19.71 $-14.81$	-12.24 $-14.64$
Seventh Day Adventist	33.21	-31.66	-17.76	-36.00	-26.07	-10.99	-29.26
Unitarian	13.98	17.52	- 3.70	- 5.23	35.00	26.83	11.14
Protestant (undefined)	9.41	7.57	9.40	3.55	7.47	10.76	8.03
Roman Catholic	<b>—</b> 6.84	- 9.27	7.39	5.71	5.31	12.28	-7.67
Greek Catholic	61.55	61.29	66.13	54.22	78.89	20.00	63.72
Catholic (undefined)	<b>7.90</b>	- 2.84	8.04	- 8.51	-2.55	2.93	- 5.56
Others	7.54	10.65	— 7.76 	.11	1.31	5.24	7.07
Christian	_ 3.61	6.26	3.60	<b>— 4.83</b>	—1.30	- 7.64	- 4.62
NON-CHRISTIAN-							
Hebrew	4.70	2.22	13.49	.13	10.01	7.87	4.25
Confucian	98.34	99.00	91.45	100.00	98.06	100.00	98.07
Mohammedan	68.09	62.07	27.66	100.00	92.98		67.63
Buddhist	92.62	100.00	100.00	100.00	90.00	100.00	92.64
Pagan	100.00	100.00	100.00	100.00	66.67	100.00	99.27
Others	79.87	60.64	41.41	33.33,	47.95	50.00	65.57
Non-Christian	26.67	19.78	37.34	8.55	31.07	17.76	24.10
INDEFINITE—							
Freethinker	56.29	49.76	61.29	50.48	64.41	14.29	53.97
Agnostic	67.76	46.36	48.30	63.48	59.70	42.86	56.35
No Denomination	18.15	15.76	27.27	22.52	13.18	.00	17.09
Others	10.92	3.65	30.11	33.33	23.00	7.69	10.67
Indefinite	35.20	20.09	40.47	40.31	37.69	16.07	29.02
O RELIGION-			-				
77 . T. 11 .	00.00			4=	00.00	05.00	W = 3.0
No Religion	62.21	54.28	56.42	47.57	62.02	65.96	57.18
Atheist Others	71.19	49.45	68.00 77.78	65.22	$\begin{array}{c} 71.43 \\ 100.00 \end{array}$	100.00	$63.24 \\ 55.81$
Others	29.73	64.29		100.00		••	00.01
No Religion	62.12	54.18	57.65	48.99	62.92	66.67	57.51
ALL RELIGIONS	2.87	<b> 5.61</b>	3.03	4.48	<b>—</b> .31		3.96

For the Metropolitan areas, taken as a whole, all the Christian denominations except four exhibited a preponderance of females. In the Non-Christian, Indefinite and No Religion groups a preponderance of males was in evidence throughout.

The following table shews the proportion per cent. of the adherents of the various denomina tions and sects resident in each State, who were enumerated in the Metropolitan area of that State, similar information being given for the Commonwealth as a whole in respect of the aggregate for Metropolitan areas.

RELIGION. 215

Proportion per cent. of Adherents who were resident in Metropolitan Areas (sexes combined), 1911.

Religion.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	All Metro- politan.
CHRISTIAN—	%_	9/	0/	%	0/	0/_	0/
Church of England	39.41	% 48.42	% 23.31	56.13	% 38.83	% 21.96	$\frac{\%}{39.93}$
Presbyterian	34.32	38.01	23.54	41.23	41.99	20.30	34.63
Methodist	28.51	36.57	24.92	38.08	35.14	13.56	32.21
Baptist	45.06	63.29	40.40	63.29	43.78	13.64	52.79
Congregational	68.45	63.01	32.86	56.38	62.72	27.72	56.80
Lutheran	26.19	22.85	11.65	9.70	31.59	26.24	14.84
Church of Christ	57.00	58.53	20.97	66.58	54.68	23.60	56.46
Salvation Army	28.09	49.17	20.42	39.91	39.76	14.74	34.84
Seventh Day Adventist	27.40	45.86	16.46	42.37	33.26	35.90	33.75
Unitarian	74.54	70.40	35.53	76.10	52.98	53.95	69.08
Protestant (undefined)	50.72	55.21	24.54	51.62	35.18	37.02	45.06
Roman Catholic	36.61	43.43	21.77	47.22	33.92	20.82	36.30
Greek Catholic	45.02	80.44	23.53	50.92	45.43	24.39	47.41
Catholic (undefined)	40.00	46.55	15.23	41.45	34.03	14.52	36.90
Others	53.77	60.40	29.10	64.80	50.89	20.71	47.98
Official	00.77			01.00		20.71	
Christian	37.95	44.43	23.20	46.37	38.22	20.86	37.89
NON-CHRISTIAN							
Hebrew	82.54	88.36	56.14	92.57	72.53	65.44	82.90
Confucian	43.41	64.32	5.84	11.11	47.58	8.47	24.84
Mohammedan	9.07	11.81	5.42	3.87	2.93		5.59
Buddhist	41.92	37.10	2.27	28.13	6.98	1.57	11.03
Pagan	26.99	65.83	2.75	66.67	6.63	70.00	29.63
Others	40.58	43.12	8.36	55.45	22.39	8.00	29.15
Non-Christian	61.22	75.25	10.39	54.34	26.38	27.16	46.46
NDEFINITE							
Freethinker	42.34	50.67	13.72	44.30	25.32	22.11	35.74
Agnostic	63.27	69,47	28.21	58.38	33.67	43.08	54.99
No Denomination	49.04	54.64	34.65	36.63	46.91	15.89	46.75
Others	62.53	72.37	25.27	54.19	41.58	29.32	58.59
Indefinite	55.94	64.53	23.48	48.50	35.86	25.23	50.60
NO RELIGION—			·		_		_
No Religion	52.99	57.93	18.90	50.39	27.00	22.38	43.21
Atheist	55.66	58.71	22.94	45.10	18.67	16.67	44.74
Others	48.05	46.67	42.86	50.00	31.25	10.07	44.33
Control	10.00	10.01	- III.00		01.20		*****
No Religion	53.05	57.73	19.37	50.14	26.59	21.62	43.32
ALL RELIGIONS	38.23	44.77	23.02	46.42	37.85	20.89	38.03

The religion which had the highest proportion of its adherents resident in Metropolitan areas was the Hebrew, while the Mohammedan religion had the lowest proportion so resident. In the former case 82.90 per cent. of the adherents were Metropolitan residents, and in the latter only 5.59 per cent.

Amongst the Christian denominations, four, viz., Unitarian, Congregational, Church of Christ, and Baptist, had more than 50 per cent. of their adherents resident in Metropolitan areas.

Of the four leading denominations, the Church of England had the largest proportion resident in Metropolitan areas, followed in order by the Roman Catholic, the Presbyterian and the Methodist Churches.

11. State Sub-divisions.—The number of adherents of each of the classified heads of religion are given in the Detailed Tables for the various State sub-divisions adopted for the purpose of the tabulation. Those relating to New South Wales Counties will be found on pp. 828 to 839; to Victorian Counties on pp. 840 to 843; to Queensland Census Districts on pp. 844 to 849; to South Australian Counties and Divisions on pp. 850 to 853; to Western Australian Statistical Districts on pp. 854 to 857; to Tasmanian Municipalities on pp. 856 to 861; to the Northern Territory on pp. 860 and 861; and to the Federal Territory on p. 862.

## CHAPTER XVI.

## BLINDNESS AND DEAFMUTISM.

- 1.—Nature of Inquiry.—In previous Censuses taken in Australia it has been usual to make a somewhat comprehensive inquiry relative to the sickness and infirmity existing amongst the population at the date of the Census. Thus, at the Census of 1891 the instructions for filling in particulars on the schedule under the heading "Sickness and Infirmity," were as follows:—
- "If laid up or unable to follow usual occupation by reason of illness or accident, write 'Sick,' or 'Accident,' or if afflicted by any of the following infirmities write Deaf and Dumb, Blind, Insane, Idiotic, Epileptic, Paralytic, Leprous, Lost a Limb, Lost an Eye, as the case may be." Owing to the defective nature of the returns received under many of these heads, more particularly in connexion with insanity, idiocy, and epilepsy, it was decided in connexion with the Census of 1901 to omit reference to all the specific infirmities enumerated above, with the exception of blindness and deaf-mutism. The instructions for supplying particulars as to sickness and infirmity on that schedule were accordingly modified as follows:—
- "If laid up or unable to follow usual occupation by reason of illness or accident, write 'Sick' (stating descriptive name of illness), or 'Accident' (assigning cause), or if Deaf and Dumb or Blind, state so."

A careful consideration of the results obtained at the Census of 1901 led to the conclusion that in drafting the schedule for the 1911 Census further modification might with advantage be made. The information supplied under the heads of sickness and accident was in many cases vague and ill-defined, notwithstanding the request for distinct specification. Further, it was obvious that a return of sickness taken for a specified date would furnish but an unreliable indication to the annual sickness-experience of the community, owing to the marked seasonal variations which exist both in the nature and range of sickness. Under the circumstances it was believed to be preferable to omit all inquiries of this character, excepting those relative to blindness and deafmutism clearly defined. In accordance therewith the inquiry on the personal card was: "State if blind or deaf and dumb," while the corresponding instruction given was as follows:—"Information is required only as to blindness and deaf-mutism. Enter as blind only persons totally unable to see, and as deaf and dumb only those who are dumb as well as deaf." In spite of these explicit instructions many cards were received containing the statement "partially blind," or "deaf only." Such items of information were ignored in the process of tabulation.

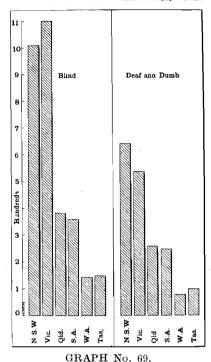
- 2. Tabulation of Data.—At the stage of the general tabulation work at which the consistency of the various replies were being checked and the classification of birthplaces and religions was being carried out, instructions were given that in the case of any card relating to a person stated to be "deaf and dumb" or "blind," a duplicate card should be written out, marked "duplicate," and handed to the officer in charge of the section. At the same time the infirmity item on the original card was required to be ticked, thus furnishing an indication at any later stage of the completeness of the duplicating work. The object of the duplication was to save the labour and inconvenience incidental to a special sorting of the whole of the cards to extract those relating to infirmities. Data concerning blind persons and deaf mutes were tabulated under the heads of States of enumeration according to Sex, Age, Birthplace, Conjugal Condition, and Occupation. Full details are given in Volume II. pp. 865 to 895.
- 3. Totals for States of Enumeration.—Of the total of 3142 persons in the Commonwealth recorded as blind at the date of the Census, 21 were recorded as being also deaf and dumb. The total number of deaf mutes recorded was 1852, including the 21 who were also blind. No blind persons or deaf mutes were recorded in either the Northern Territory or the Federal Territory. The totals for the several States are as follows:—

Blind Persons and Deaf Mutes recorded at Census of 3rd April, 1911.

STATE OF			BUT NOT			and Dum not Blin		BLIN	DEAF N	Iutes.
Enumeration.		Males.	Females	Persons.	Males.	Females	Persons.	Males.	Females	Persons
New South Wales		590	419	1.009	329	309	638	1	1	2
Victoria		589	504	1,093	274	252	526	6	3	9
Queensland		210	167	377	157	94	251	3	3	6
South Australia		192	165	357	134	111	245		1	1
Western Australia		84	57	141	39	36	75	1		1
Tasmania	• •	76	68	144	52	44	96	2		2
Total, C'wealth		1,741	1,380	3,121	985	846	1,831	13	8	21

For the Commonwealth as a whole, blind persons represented 71 per 100,000 of the total population. In New South Wales the proportion blind was 61 per 100,000; in Victoria 84; in Queensland 63; in South Australia 88; in Western

Blind Persons and Deaf Mutes, 1911.



Australia 50; and in Tasmania 76.

In the case of deafmutism the proportion for the Commonwealth as a whole was 42 per 100,000 of total population, whilst for the several States the corresponding proportions were as follows:—New South

population, whilst for the several States the corresponding proportions were as follows:—New South Wales, 39; Victoria, 41; Queensland, 42; South Australia 60; Western Australia, 27; and Tasmania, 51.

In the case of both the infirmities dealt with, Western Australia and New South Wales occupy the most favourable positions, and South Australia the least favourable. As the population of the two former States have benefited largely by interstate migration, while that of South Australia has lost heavily from this cause, it is probable that the proportions deduced above are to some extent due to the selective influence of migration, the infirm being less likely to migrate than the more robust.

In the accompanying graph (No. 69) a representation is furnished of the number of persons (sexes combined) in the several States who were blind, or who were deaf and dumb at the Census of 3rd April, 1911.

4. Infirmity and Age.—Details respecting the ages of blind persons and deaf mutes were tabulated for each sex in quinquennial age groups for each State of

enumeration. Particulars for the Commonwealth are given in the following table after distribution of the number whose ages were unspecified:—

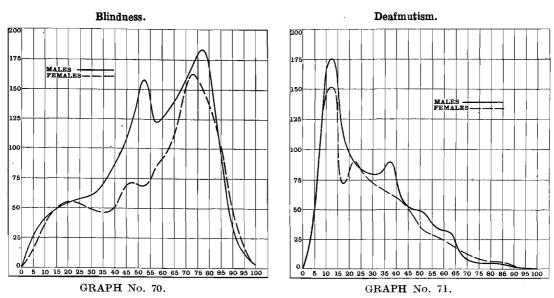
Blindness and Deafmutism according to Age, Commonwealth, 1911.

	~			BUT NOT			AND DUM OT BLIND		BLIN	DEAF M	IUTES.
AGE (	GROUP.	•	Males.	Females	Persons.	Males.	Females	Persons.	Males.	Females	Persons
0–4			12	13	25	18	17	35	1		1
5-9			35	19	54	102	96	198	1		1
1014			40	43	83	169	149	318	3	1	4
15-19			55	51	106	112	74	186	1	1	2
20-24			53	53	106	89	90	179		1	1
25-29			59	49	108	82	74	156			
30-34			61	50	111	78	70	148	1	1	2
35-39			79	42	121	88	60	148	1	1	$\frac{2}{2}$
40-44			95	59	154	58	55	113	2		2
<b>45–4</b> 9			118	72	190	50	44	94			
<b>50–54</b>			158	67	225	46	30	76		1	1
55–59			125	88	213	33	28	61			
60–64	• •		132	96	228	31	18	49	1		1
65-69			153	128	281	12	15	27	1	1	2
7074			160	161	321	6	10	16		1	1
75–79			186	147	333	5	7	12			
80-84			129	128	257	4	6	10	l		1
85–89			65	75	140	1	1	2			
90-94			19	32	51		1	1 1			
95–99	• •	• •	7	7	14	1	1	. 2	• •	• • •	• •
Total			1,741	1,380	3,121	985	846	1,831	13	8	21

An interesting point brought out by the above table is the marked difference in age distribution between the blind and the deaf mutes. Thus the numbers of blind persons in successive age-groups increases with fair regularity to a maximum of 333 for the age-group 75–80, and then declines rapidly to the oldest ages. On the other hand the numbers of deaf mutes in successive age groups increase rapidly to a maximum of 318 for the age group 10–14, descending thence rapidly to the group 15–19, and thereafter declining gradually to the oldest ages. The age distribution in the case of the blind suggests that blindness is relatively rarely congenital, but that it occurs mainly in the middle and old ages from accident, disease or senility.

The distribution in the case of deaf mutes is not so readily explicable. Deafmutism is usually congenital, and consequently would be expected to be most largely represented in the earliest age groups. Possibly the hope of eventual recovery prevents many parents from recording the fact at the early ages. It is also possible that the fear that some action might be taken by the authorities for the removal of deaf mutes for educational purposes may induce some parents to avoid the disclosure. The rapid falling off in number after age group 10-14 may be due to several causes of which the most probable appears to be that there is fairly complete enumeration at age 10-14, when the majority are receiving specialised education, and the persons responsible for supplying the information are teachers who are not in any way interested in withholding information, and that persons of more advanced years are less inclined to mention their infirmities when filling in their own cards. Another possible explanation would be the immigration of some 130 deaf mutes within recent times aged under 15. Such an explanation taken in conjunction with the deferred-hope explanation given above for age 0-4 would furnish a series diminishing with age from 15 onwards. It is, however, negatived, firstly by absence of record of any such immigration, and secondly, by the record of the birthplaces of the deaf mutes. Another possible but improbable explanation is that there has been a marked increase in deafmutism in comparatively recent times, whilst an equally improbable explanation is, that the death rate amongst deaf mutes is excessive at age 15-19. Under all the circumstances it appears probable that the true explanation is relative completeness of record at age 10-14, and relative incompleteness for earlier and later ages. Probably as the community learns to appreciate the sociological importance of statistic, such returns as these will increase in accuracy.

## Blindness and Deafmutism according to Age. Commonwealth, 1911



The accompanying graphs (Nos. 70 and 71) furnish a representation of the number of blind persons and deaf mutes of each sex at each age in the Commonwealth at the Census of 3rd April, 1911, The base of each small rectangle represents 5 years of age, and the vertical height represents 25 persons.

The proportions per 100,000 of population for the age groups 0-14, 15-64, and 65 and upwards are shewn in the following table:—

Proportion of Blind Persons and Deaf Mutes per 100,000 of Population, Commonwealth, 1911.

•	~			BUT NOT			AND DUM		Blin	DEAF M	Iutes.
AGE	JROU.	P.	Males.	Females	Persons.	Males.	Females	Persons.	Males.	Females	Persons
0-14 15-64			12.2 62.4	10.8 46.3	11.5 54.8	$40.4 \\ 44.5$	37.6 40.1	39.1 42.4	0.7 0.4	0.1	0.4 0.4
65 and over ALL AGES	• • •	• •	711.9 75.3	746.7 64.4	728.3 70.1	$\frac{28.7}{42.6}$	45.2 39.5	36.5 41.1	2.0 0.6	2.2 0.4	$\begin{array}{c c} 0.4 \\ 2.1 \\ 0.5 \end{array}$

These figures accentuate the remarks already made concerning the age incidence of blindness. It will be seen that, taking the blind deaf mutes into account, blind persons represented 11.9 per 100,000 of those aged under 15; 55.2 per 100,000 of those between 15 and 65; and 730.4 per 100,000 of those aged 65 and over. In other words, of the Australian population under the age of 15, one in every 8400 was blind, as were also one in every 1800 between the ages of 15 and 65, and one in every 137 aged 65 and over.

On the other hand, in the case of deafmutism, the variations with age are not large, and taking into account what has been said above concerning the evidence of defectiveness of the returns at certain ages, it would appear probable that the proportion of deaf mutes is relatively constant at all ages, and is somewhat in excess of 43 per 100,000.

Of blind persons under the age of 15, one in every 28 was also a deaf mute, the corresponding proportion for blind persons between 15 and 65 being one in every 143, and for those aged 65 and over, one in every 350.

5. **Infirmity and Birthplace.**—A summary of the information in respect of the birthplaces of blind persons and deaf mutes, recorded at the Census is given in the following table:—

Blindness and Deafmutism according to Birthplace, Commonwealth, 1911.

		BUT NOT AND DUMI			AND DUM		BLIN	DEAF N	Iutes.					
BIRTHPLACE.	Males.	Females	Persons.	Males.	Females	Persons.	Males.	Females	Persons					
NUMBER.														
Australia	827	625	1,452	855	746	1,601	10	6	16					
New Zealand	8	606	15	5	10	15	٠٠,							
United Kingdom	758 50	686	1,444	$\frac{97}{13}$	76	$\begin{array}{c} 173 \\ 20 \end{array}$	1	1	<b>2</b>					
Germany United States of America	30 7	37	87 10	2	7	3	,		,					
China	$2\dot{1}$	_	21	$\frac{2}{2}$		$\frac{3}{2}$	_	••						
Other Countries	70	22	92	11	6	17	1	1	2					
TOTAL	1,741	1,380	3,121	985	846	1,831	13	8	21					
1	PRO	PORTIO	N PER 10	00,000 O	F POPUI	ATION.								
Australia	44.7	34.0	39.4	46.2	40.6	43.4	0.5	0.3	0.4					
New Zealand	47.1	46.3	46.7	29.4	66.1	46.7								
United Kingdom	222.3	266.7	241.4	28.4	29.6	28.9	0.3	0.4	0.3					
Jermany	227.6	324.3	260.6	59.2	61.4	59.9	. ,	1						
United States of America China	155.6	135.4	148.9	44.5	45.1	44.7	23.3	••	14.9					
Other Countries	$101.6 \\ 122.9$	124.0	$\begin{array}{c} 100.0 \\ 123.2 \end{array}$	$\begin{array}{c} 9.7 \\ 19.3 \end{array}$	33.8	$\begin{array}{c} 9.5 \\ 22.8 \end{array}$	1.8	5.6	2.7					
	122.9	124.0	143.2	19.3	33.8	44.8	1.8	0.6	2.7					
omer countries														

The relatively high proportions of blind persons amongst those born in the United Kingdom and Germany, and the relatively low proportions among those born in Australia and New Zealand are due in large measure to the age distribution of those born in the countries specified. The Australian residents born in the United Kingdom or Germany contain a much larger proportion of persons of middle age and old age than do those born in Australia or New Zealand.

6. Infirmity and Conjugal Condition.—The conjugal condition of blind persons and deaf mutes is shewn in summary form in the following table:—

Blindness and Deafmutism according to Conjugal Condition, Commonwealth, 1911.

		BUT NOT AND DUMI			AND DUM		BLIN	D DEAF N	Iutes.
CONJUGAL CONDITION.	Males.	Females	Persons.	Males.	Females	Persons.	Males.	Females	Persons
Married Never Married-under 20 20 and over Widowed Divorced		366 126 356 531	1,014 268 983 850 6	140 401 430 13	149 336 329 31 1	289 737 759 44 2	6 7	 2 4 2	 8 11 2
TOTAL	1,741	1,380	3,121	985	846	1,831	13	8	21

Of 2866 blind persons above the age of 20, at the date of the Census, 1014, or more than 35 per cent., were married; 852, or rather less than 30 per cent., were widowed; while 6, or about 2 per thousand, had been divorced; and 994, or somewhat less than 35 per cent., had never been married.

Of 1094 deaf mutes above the age of 20, 289, or about 26 per cent., were married; 44, or about 4 per cent., were widowed; while 2, or say 2 per thousand, had been divorced; and 759, or rather less than 70 per cent., had never been married.

7. Infirmity and Occupation.—Blind persons and deaf mutes were further tabulated according to the occupations specified on their personal cards. In some cases the occupations so specified were no doubt being followed at the time of the Census, but in other cases it appears probable that the occupation stated, more particularly in the case of the blind, was that followed prior to the occurrence of the infirmity. A summary of the results for the Commonwealth as a whole is furnished in the following table:—

Blindness and Deafmutism according to Occupation, Commonwealth, 1911.

		OCCUPATION.		D BUT			NOT B			IND DE MUTES.	
Order	Sub- order	Designation.	Males.	Fe- males.	Per- sons.	Males.	Fe- males.	Per- sons.	Males,	Fe- males.	Per- sons.
		CLASS I.—PROFESSIONAL.	10	1		,	,	2			I
$\frac{1}{2}$		Engaged in Government, Defence, Law, etc. Ministering to Religion, Charity, Health, Education, etc	10 88	26	111	26	1 9,	1			···
		TOTAL—CLASS I	98	27	125	27	10	37			
3	1	CLASS II.—DOMESTIC. Engaged in supplying Board and Lodging	4	5	9	4	5	9			
	2	,, Domestic Service and Attendance TOTAL—CLASS II	15	13	32	14	49 54	63 72	··-		<del></del> -
		TOTAL CHASS II				10					
4 5 6 ·		CLASS III.—COMMERCIAL. Dealing in Property and Finance Art and Mechanic Productions Textile Fabrics, Dress and Fibrous	46 14	13 1	59 15	3	3 1	6 2	::	••	::
7		Materials	3		3	2		2		••	
8		Stimulants ,, Animal and Vegetable	34	1	35	6		6		• • •	
9 10		Substances, N.E.I	5 3		$\begin{array}{c} 1 \\ 5 \\ 3 \end{array}$	$\frac{1}{2}$		2			
$\frac{11}{12}$		General and Undefined Merchants and Dealers Speculators on Chance Events	37	4	41	10		$\frac{10}{2}$			
$\hat{1}\bar{3}$		Engaged in Storage							::	-:-	
		TOTAL—CLASS III	143	19	162	27	4	31		• •	
14	1 2 3	CLASS IV.—TRANSPORT AND COMMUNICATION. Engaged in Railway Traffic ,, Traffic on Roads	1 10		1 10	2 3		2 3			
	3 4 & 5	", Seas and Rivers". ", Postal, Telegraph and Telephone	14		14	6	· · ·	6			
	6	Service						1			::
		TOTAL—CLASS IV	. 26		26	12		12			
15 <b>16</b>		CLASS V.—INDUSTRIAL. Working in Art and Mechanic Productions Textile Fabrics, Dress, and Fibrous	215	59	274	86	3	89		1	1
17	ļ	Materials Food, Drinks, Narcotics, and	71	3	74	66	39	1,05	1	••	1
18		, Animal and Vegetable Substances,	15		15	22		22			
19 20		N.E.I	10	::	10	28		28	1	•••	1
21		Energy Engaged in Construction of Buildings, Roads,	2		2		• • •				
22		Railways, etc	30		30	18	:: <u>.</u>	18	::	• • •	
23		", Undefined Industrial Pursuits Total—Class V	91 437	65	502	$-\frac{32}{259}$	43	33	4	1	$\frac{2}{5}$
		TOTAL CLASS V	101		- 502			- 502			<b>_</b>
24	$\begin{array}{c c} 1\\2\\3\end{array}$	CLASS VI.—PRIMARY PRODUCERS. Engaged in Agricultural Pursuits Pastoral Pursuits Capture, etc., of Wild Animals and	91 42	4 1	95 43	106 40	1 2	107 42			• • • • • • • • • • • • • • • • • • • •
	4 5	their Produce	2 3		2 3	3 4 9		3 4 9	::		::   ::
	6 7	,, Water Conservation and Supply ,, Mining and Quarrying	64		64	7		,	::		••
		TOTAL—CLASS VI	202	5	207	169	3	172			
25		CLASS VII.—INDEPENDENT	265	107	372	12	9	21	••		
		Total—Breadwinners	1,190	236	1,426	524	123	647	4	1	5
26 27	1 2	CLASS VIII.—DEPENDENTS. Dependent on Natural Guardians Supported by Voluntary or State Contributions Criminal Class (under Legal Detention)	447 104	1,016 128	1,463 232	379 82	655 68	1,034 150	8 1	4 3	12 4
		TOTAL—CLASS VIII	551	1,144	1,695	461	723	1,184	9	7	16
		GRAND TOTAL	1,741	1,380	3,121	985	846	1,831	13	8	21

In the following table is given a summary of the particulars in respect of occupation and age for blind persons and deaf mutes:—

Blindness and Deafmutism according to Occupation and Age, Commonwealth, 1911.

	OCCUPATION		•	MAL	ES.			FEMA	ALES.			PER	sons.		
	OT THE COLUMN CO			Age l	last Birt	hday.	All	Age l	ast Birt	hday.	All	Age l	ast Birt	hday.	All
Class.	Designation.			0–14	15–64	65 & over.	Ages.	0–14	15-64	65 & over.	Ages.	0–14	15–64	65 & over.	Ages
BLIND BUT NOT DEAF AND DUMB.															
I. II. III. V. VI. VII. VIII.	Professional Domestic Commercial Transport and Comm Industrial Primary Producers Independent Dependents	unicatio	on	1 86	77 10 79 10 311 83 88 277	21 9 64 16 126 119 176 188	98 19 143 26 437 202 265 551		25 8 5  63 3 26 497	2 5 14  2 2 81 572	27 13 19 .65 5 107 1,144	    1	102 18 84 10 374 86 114 774	23 14 78 16 128 121 257 760	125 32 162 26 502 207 372 1,695
	TOTAL			87	935	719	1,741	75	627	678	1,380	162	1,562	1,397	3,121
							<u> </u>	i	<u> </u>				<del></del>		
			I	DEAF	AND D	UMB.	BUT N	OT BL	IND.				·	<u>.</u>	
I. III. III. V. VI. VII. VIII.	Professional Domostic Commercial Transport and Comm Industrial Primary Producers Independent Dependents	unicatio		DEAF 288	26 17 25 12 250 163 8 166	UMB : 1 1 2 8 6 4 7	27 18 27 12 259 169 12 461	OT BL	IND.  10   53   1   43   3   7   426	 3   2 35	10 54 4  43 3 9 723	1 550	36 70 26 12 293 166 15 592	1 2 5  8 6 6 42	72 31 12 302 172 21
II. III. IV. V. VI. VII.	Domestic Commercial Transport and Comm Industrial Primary Producers Independent	unicatio	on	   1	26 17 25 12 250 163 8	1 1 2  8 6 4	27 18 27 12 259 169 12		10 53 1  43 3	$\begin{array}{c} 1 \\ 3 \\ \cdots \\ \vdots \\ 2 \end{array}$	54 4  43 3 9	1	70 26 12 293 166 15	2 5  8 6 6	37 72 31 12 302 172 21 1,184
II. III. IV. V. VI. VII.	Domestic Commercial Transport and Comm Industrial Primary Producers Independent Dependents	unicatio	on	  1  288	26 17 25 12 250 163 8 166	1 1 2  8 6 4 7	27 18 27 12 259 169 12 461	262	10 53 1 43 3 7 426	1 3   2 35	54 4  43 3 9 723	550	70 26 12 293 166 15 592	2 5  8 6 6 42	72 31 12 302 172 21 1,184
II. III. IV. V. VI. VII.	Domestic Commercial Transport and Comm Industrial Primary Producers Independent Dependents	unicatio	on	  1  288	26 17 25 12 250 163 8 166	1 1 2  8 6 4 7	27 18 27 12 259 169 12 461	262	10 53 1 43 3 7 426	1 3   2 35	54 4  43 3 9 723	550	70 26 12 293 166 15 592	2 5  8 6 6 42	72 31 12 302 172 21 1,184

Classified according to grade of occupation, particulars in respect of blind persons and deaf mutes are as follows:—

Blindness and Deafmutism according to Grade of Occupation, Commonwealth, 1911.

	OCCUPAT	OCCUPATION. MALES, FEMALES. PERSONS.																						
ca.						Gr	ades			ll des.			Gı	ades	s.		lles.			Gı	ades	3.		les.
Class.	Designat	ion.		Е	0	A	$ \mathbf{w} $	N	NA	All Grades.	E	o	A	w	N	NA	All Grades.	E	o	A	w	N	NA	All Grades.
					Е	LI	ND I	BUI	ron 1	DEA	AF.	AND	D	UMI	В.									
I. II. III. IV.	Professional Domestic Commercial Transport & Cor	  mmnnica	 	6 4 26	32 22		19 1 11		41 14 84	98 19 143	1 2 3	10 1 2	i	11 		5 9 13	27 13 19	7 6 29	42 1 24	i	30 1 12		46 23 97	
VI. VII. VIII.	tion Industrial Primary Produc Independent Dependents	ærs 		21 37 	16 15 	1 9 	184 	10 	23 205 141 265 551	26 437 202 265 551	··· 2 ···	3 1	1 1	54	`i	 6 107 1,144	65 5 107 1,144	39	1 19 16	2 10	238 	ii 	23 211 142 372 1,695	26 502 207 372 1,695
	TOTAL			96	86	10	215	10	1,324	1,741	8	17	3	66	1	1,285	1,380	104	103	13	281	11	2,609	3,121
					D	EA	F A	ND	DUM	в ви	T N	тот	В	LIN	D,			_						
I. II. III. IV.	Professional Domestic Commercial Transport & Cor	nmunios			2	i		1	2 1 5	27 18 27	 i	1	.:	8 47 1	::	· 1 7 2	10 54 4	 i	3	i	30 63 14	1	3 8 7	37 72 31
V. VI. VII. VIII.	tion Industrial Primary Product Independent Dependents			1 3 11 	15 25 		10 210 92 	14 5	1 16 2 12 461	12 259 169 12 461	· · · · · · · · · · · · · · · · · · ·	. <del>,</del> ,	 3 	33		723	43 3 9 723	1 5 11 	22 25 	37 	10 243 92 	14 5 	$\begin{array}{c} 1\\17\\2\\21\\1,184\end{array}$	12 302 172 21 1,184
	TOTAL			15	51	36	363	20	500	985	3	8	3	89		743	846	18	59	39	452	20	1,243	1,831
							E	3L <b>I</b> 1	ND D	EAF I	M U	res.												
v. viii.	Industrial Dependents	••		<u>.</u> .	1	• •		• •	3 9	4 9		1					1 7		2	,			3 16	5 16
	TOTAL	••			1		• •	• •	12	13	•	1	•••			7	8	• •	2	•••	•	•	19	21

Note.—E denotes Employer; O, working on own account, but not employing labour; A, assisting but not receiving wages or salary W, in receipt of wages or salary; N, unemployed; N A, grade not applicable.

## CHAPTER XVII.

## NON-EUROPEAN RACES.

1. Nature and Scope of Inquiry.—The subject of "race" is not specially mentioned in the Census and Statistics Act 1905, as one of the items of inquiry, but owing to the interest taken by the people of Australia in the question of Non-European population it was deemed advisable to make race one of the "prescribed matters," and to obtain and tabulate particulars in respect of persons of Non-European race. For this purpose a line on the personal card was marked "Race...." and an instruction to the following effect was provided:— "If not of European race, write Aboriginal, Chinese, Japanese, Hindu, Javanese, Manilaman, Negro, Polynesian or Aboriginal half-caste, Chinese half-caste, etc., etc., as the case may be. For all general tabulations, including those relating to Non-European races, the cards relating to full-blooded Australian Aboriginals were eliminated, owing to the provision of Section 127 of the Commonwealth Constitution, that "in reckoning the number of the people of the Commonwealth, or of a State or other part of the Commonwealth, aboriginal natives shall not be counted." In this matter an opinion has been given by the Commonwealth Attorney-General's Department that persons of the half-blood are not "aboriginal natives" for the purposes of the Constitution, and a fortiori that persons of less than half aboriginal blood are not aboriginal In the results dealt with in this Chapter, and tabulated in detail on pp. 897 to 1073 of the Detailed Tables, half-caste aboriginal natives have been included, those having Aborignal blood to a less degree than one-half, and European blood to a greater degree than one-half, being included for tabulation as European. A similar proviso applies to those classed as half-castes of other races than aboriginal. In this connexion it may be noted that as the tabulation was essentially one distinguishing between European and Non-European races, those classified as half-caste have European blood in their veins to the degree of one-half. Where the parents of children were both of Non-European race, but not the same race, the children were classed as Non-Europeans of full blood, and tabulated according to the race of the father.

In previous Censuses taken in Australia it has been usual to distinguish, both in the inquiry and in the subsequent tabulation, between Chinese, Aboriginal Natives and the rest of the population, but not to deal extensively with other classes of Non-Europeans.

2. Tabulation.—In tabulating the data on the present occasion, the procedure followed has been that of including the Non-European races with the rest of the population for all purposes, and of tabulating and publishing separately the data in respect of Non-Europeans for the more important heads of inquiry.

In this tabulation the sexes have been distinguished, and particulars for full-bloods and half-castes have been shewn separately. The heads under which these particulars have been tabulated are age, nationality, length of residence, education, conjugal condition, birthplace, and occupation.

3. Number and Distribution.—The States in which persons of Non-European race were most numerous were New South Wales and Queensland, these two States together accounting for about 60 per cent. of those of full-blood and more than 67 per cent. of the half-caste. A summary of the numbers in each of the States and Territories is furnished in the following

Non-European Races in States and Territories, 1911.

States	Aus- tral- ian.	Asia	tie.	Afri	can.	Amei	rican.	Polyr	nesian.	Inde	finit⊖.	All Europ Rac	
and Territories.	Half- caste.	Full blood	Half- caste.	Full blood.	Half- caste.	Full blood.	Half- caste.	Full blood.	Half- caste.	Full blood.	Half- caste.	Full blood.	Half- caste.
					М	IALES.							
States-													
N.S.W	2,335	10,054	705	142	95	10	7	301	35			10,507	3,177
Vic	237	5,539	571	47	27	6	4	7	2	1	2	5,600	
Q'land	1,361	8,568	465	47	42	29	1	1,782	83			10,426	
S.A	346	936	84	15	12	4	1	2	2			959	
W.A	760	5,400	64	47	12	5	2	22	3			5,474	
Tas	123	464	68	4	3			5	1			473	195
TERRITORIES				1				İ				:	
N.T	117	1,468	18	7		i , ••		11				1,486	
F.T	4	7				•••	••	!				7	4
C'wealth	5,283	32,436	1,975	309	191	54	15	2,130	126	3	2	34,932	7,592

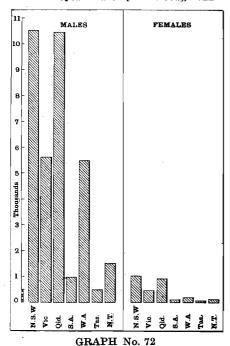
Non-European Races in States and Territories, 1911.—continued.

States	Aus- tral- ian.	Asia	itie.	Afri	can.	Ame	rican.	Polyn	esian.	Indet	inite.	Euro	Non- pean ces.
and Territories.	Half- caste.	Full blood	Half- caste.	Full blood.	Half- caste.	Full blood.	Half- caste.	Full blood.	Half- caste.	Full blood.	Half- caste.	Full blood.	Half- caste.
		,			FE	EMALE	s.	<u>'</u>	'	-		<u></u>	
STATES—			-										
N.S.W	2,177	929	685	27	71			42	35	2		1,000	2,968
Vic.	210	433	485	11			5	1				449	739
Q'land	1,147	555	$\frac{475}{475}$	6		8						910	1,708
CI A	346	113	91			1	_	3			••	120	448
TTT A	715	178	65			$\stackrel{1}{2}$	• • •	3			• •		
$\mathbf{W.A.}$ $\mathbf{Tas.}$	104	68	59	_	3	2		3	٠٠ ,	• •	• • •	184	$\begin{array}{c} 783 \\ 163 \end{array}$
TERRITORIES	104	- 00	59	• •	3	• •	• •	• •	1	• • •	• •	68	10.
37 03	127	126	17						٠,			100	14
T1 m		120			••	• •	• •	• •	1	• •	• • •	126	14
F.T	4	• •	• •	• •	• • •	• •	• • •	• •	• •	• •	• •	••	4
C'wealth	4,830	2,402	1,877	48	145	11	9	394	101	. 2	• •	2,857	6,965
•						PERSC	NS.	·					
STATES—			-										
AT CLASS	4,512	10,983	1,390	169	100	10	-	0.40	=0	9		11 505	0.14
T7:-	4,512			109 58	166	10	7	343	70	$\frac{2}{1}$	2	11,507	6,148
		5,972	1,056		63	6	9	12	5	1	Z		1,582
	2,508	9,123	940	53	65	37	5	2,123	142	••	• •	11,336	
S.A.	692	1,049	175	18	21	5		5	4	2	• •	1,079	89
W.A	1,475	5,578	129	48	15	7	2	25	3	• •	• •	5,658	1,624
Tas	227	532	127	4	6	• •		5	2			541	362
lerritories													
N.T	244	1,594	35	7			• •	11	1	• •	• • •	1,612	280
F.T	- 8	7			••		• •	• •		• •		7	8
C'wealth	10,113	34,838	3,852	357	336	65	24	2,524	227	5	2	37,789	14,554

Of the total of 37,789 persons of Non-European race (full-blood), no fewer than 34,838, or about 90 per cent., were Asiatics, whilst of the 14,554 half-castes about 70 per cent. were half-caste Australian aboriginals. For the Commonwealth as a whole persons of Non-European race (full-blood) represented 8.48 per 1000 of the population, while half-castes amounted to 3.28 per 1000.

In the accompanying graph (No. 72) a representation is furnished of the number of persons of each sex of Non-European race (full-blood) who were recorded in each of the States and the Northern Territory at the Census of 3rd April, 1911. The figures for the Federal

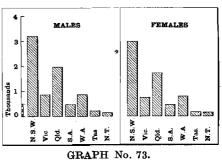
Non-European Races [Full-blood], 1911.



Territory are so small that a representation on the above scale would not be visible. This graph displays in a striking manner the relatively heavy number of such persons in Queensland, Western Australia and the Northern Territory.

Graph No. 73 furnishes for half-caste residents of the several States and the Northern Territory a representation of the half-caste Non-Europeans similar to that furnished in graph 72 for those of full-blood. In this case, also, there are relatively large numbers in Queensland and Western Australia, and comparatively few in Victoria, South Australia and Tasmania.

Non-European Races [Half-caste], 1911.



4. Principal Races Represented.—Of the various races included in the full-blood total of 37,789, six were represented by upwards of 1000 persons each. These in numerical order were Chinese 22,753, Japanese 3489, Hindus 3299, Syrians 2339, Polynesians 2068, and Malays 1077, which amongst them accounted for 35,025, or upwards of 92½ per cent. of the total. Of males of the full-blood, the Chinese preponderated, Japanese being second, Hindus third, and Polynesians fourth. Of females of the full-blood the race most numerously represented was the Syrian, the Chinese being second, Polynesian third and Japanese fourth. The races most largely represented by half-castes were the Aboriginal, the Chinese, the Hindus, the Negroes, and the Polynesians in the order named. The persons here, and subsequently in this chapter, classed as Polynesians, are those who were so described on their Census cards, and those who were described as Fijians. In the summary tables given on pp. 222 and 223, Papuans and Maoris have, in addition, been included.

For those of the full-blood the figures for the principal races for the several States and Territories are as follows:—

## Principal Non-European Races [Full-blood], 1911.

States and Territories.	Chinese.	Japan- ese.	Hindus.	Syrians.	Poly- nesians.	Malays.	Others.	Total, Non- European Races.
	· .		·		1			

#### MALES.

States		1	-					
New South Wales	 7,939	119	1.119	654	264	28	384	10,507
Winterio	 4,491	39	720	244	2	5	99	5,600
Queensland	 5,783	1,416	356	156	1,404	300	1,011	10,426
South Australia	 241	13	436	178	2	2	87	959
Western Australia	 1,775	1.609	<b>549</b> ±	17	17	674	833	5,474
Tasmania	 400		15	47	4		7	473
Territories—	 			ļ	l			
Northern	 1.224	85	4		11	24	138	1,486
Federal	 3		2	1			1	7
<b>1</b>	- <del></del> -							
COMMONWEALTH	 21,856	3,281	3,201	1,297	1,704	1,033	2,560	34,932

## FEMALES.

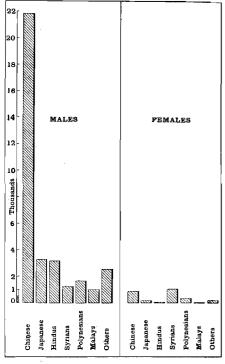
	1							
					1			
	284	7	63	540	23	1	82	1,000
	216	8	9	197	3	!	16 '	449
	212	65	17	163	335	38	80	910
	14		3	94	3		6	120
	37	123	6	7		1	10	184
	27			41				68
	- 1							
	107	5				4	10	126
		1			••			
	897	208	98	1,042	364	44	204	2,857
	• •	216 212 14 37 27 107	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

## PERSONS.

FERRITORIES— Northern Federal		1,331	90	4 2	1		28	148	$\substack{1,612\\7}$
Tasmania	• •	427		15	88	4	••	7	541
Western Australia		1,812	1,732	555	24	17	675	843	5,658
South Australia		255	13	439	272	5	2	93	1,079
Queensland $. \P$		5,995	1,481	373	319	1,739	338	1,091	11,336
Victoria		4,707	47	729	441	5	5	115	6,049
STATES— New South Wales		8,223	126	1,182	1,194	287	29	466	11,507

Total

## Principal Non-European Races [Full-blood], Commonwealth, 1911.



GRAPH No. 74.

Of the Non-European males, Chinese were most numerous in New South Wales and Queensland, Japanese and Malays in Western Australia and Queensland, Hindus and Syrians in New South Wales and Victoria, Polynesians in Queensland and New South Wales, and other races in Queensland and Western Australia.

Of females, the only instances in which more than 100 were recorded were New South Wales, Victoria, Queensland, and the Northern Territory in the case of Chinese; Queensland in the case of Japanese; New South Wales, Victoria, and Queensland in the case of Syrians, and Queensland in the case of Polynesians.

The accompanying graph (No. 74) furnishes for the Commonwealth as a whole a representation of the number of persons of each sex of the principal Non-European races (full-blood) recorded at the Census of 3rd April, 1911. It furnishes striking evidence of the preponderance of Chinese amongst the male Non-Europeans, and of the relatively large number of Syrians amongst the females.

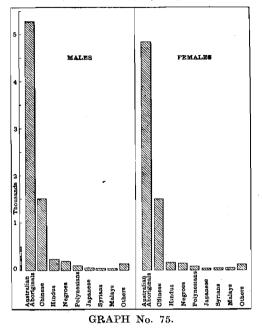
For persons of half-blood the figures for the principal races for the several States and Territories are as follows:—

Principal Non-European Races, 1911 [Half-caste].

States and Territories.	Aust, Abgnls.	Chinese	Hindus	Negroes	Poly- nesians.	Japan- ese.	Syrians	Malays.	Others.	Total, Half- caste.
			M	ALES.						
STATES-										
New South Wales	2,335	561	72	95	23	19	20	9	43	3,177
Victoria	237	465	73	27		13	11	5	12	843
Queensland	1,361	355	42	42	$\ddot{7}2$	12	6	21	41	1,952
South Australia	346	50	20	12	ī	2	2	2	10	445
Western Australia	760	33	17	12	3	5	ī	ī	9	841
Tasmania	123	50	14	3			_		5	195
Territories-	120				••	•••	••			100
Northern	117	4	1						13	135
Federal	4				• •	• • •	••			4
COMMONWEALTH	5,283	1,518	239	191	99	51	40	38	133	7,592
			I	FEMALE	es.				'	
States					ĺ					
New South Wales	2,177	571	64	71	22	13	25	2	23	2,968
Victoria	210	429	32	36	1	7	5	8	11	739
Queensland	1,147	364	26	23	49	10	l	35	53	1,708
South Australia	346	54	15	9	1		10		13	448
Western Australia	715	27	18	3		5	2		$\frac{13}{12}$	.783
Tasmania	104	52	5	3	1	1	í			167
TERRITORIES—	101	02	"	9	1	_	1	• •	• •	107
Northern	127	4			1				13	145
Federal	4		••	• •		• •	• •	•••		4
redetal				••		• •	••		• •	<del></del>
COMMONWEALTH	4,830	1,501	160	145	75	36	44	46	125	6,962
	1		PE	RSONS				,		
STATES-										
New South Wales	4,512	1,132	136	166	45	32	45	11	66	6,145
Victoria	447	894	105	63	ì	20	16	13	23	1,582
Queensland	2,508	719	68	65	121	<b>22</b>	7	56	94	3,660
South Australia	692	104	35	21	2	2	12	2	23	893
Western Australia	1,475	60	35	15	3	$1\overline{0}$	3	2	21	1,624
Tasmania	227	102	19	6	ĩ	1	Ĭ.		5	362
TERRITORIES-					_	_				
Northern	244	8	1		1	١			26	280
Federal	8	• •		••						8
COMMONWEALTH	10,113	3,019	399	336	174	87	84	84	258	14,554

Australian Aboriginal half-castes were most numerous in New South Wales and Queensland; Chinese, Hindu and Syrian half-castes in New South Wales and Victoria; Negro and

## Principal Non-European Races [Half-caste], Commonwealth, 1911.



Japanese half-castes in New South Wales and Queensland; Polynesian half-castes in Queensland and New South Wales; and Malay half-castes in Queensland and Victoria.

Australian Aboriginal half-castes and Chinese half-castes together represented 90 per cent. of the total half-caste population.

The numbers of the principal half-caste Non-Europeans are represented in graph No. 75, which furnishes particulars for both sexes for the Commonwealth as a whole as at the Census of 3rd April, 1911. In both sexes the half-caste Australian Aboriginals preponderated with half-caste Chinese next in order, the half-castes of other races being relatively unimportant.

5. Ages.—Particulars respecting the full-blood and half-caste Non-Europeans were tabulated separately in respect of age for quinquennial groups, and the results are given in pp. 906 to 933 of Vol. II. Census Detailed Tables. A summary of the Commonwealth particulars in respect of those of full-blood is as follows:—

Race and Age, Commonwealth, 1911 [Full-blood].

	Age.		Chinese.	Japan- ese.	Hindus.	Syrians.	Poly- nesians.	Malays.	Others.	Total, Nor European Races.
					MALES.					
Under 15			579	22	68	388	227	39	82	1,405
15-44			10,894	3,066	2,464	685	817	852	1,820	20,598
45 <b>-</b> 64			8,621	188	594	211	617	136	582	10,949
65 and over	• • •	• •	1,762	5	75	13	43	6	76	1,980
TOTAL			21,856	3,281	3,201	1,297	1,704	1,033	2,560	34,932
					FEMALE	s.				
Under 15			499	25	45	425	179	24	82	1,279
15-44 .			361	177	40	497	148	16	96	1,335
45-64			36	5	11	101	36	2	18	209
65 and over.			1	1	2	19	1	2	8	34
TOTAL .			897	208	98	1,042	364	44	204	2,857
			· .				•		<u> </u>	
					PERSON	S.				
Under 15			1,078	47	113	813	406	63	164	
15-44 .			11,255	3,243	2,504	1,182	965	868	1,916	
45-64 .			8,657	193	605	312	653	138	600	
65 and over.			1,763	6	77	32	44	8	84	2,014
TOTAL .			22,753	3,489	3,299	2,339	2,068	1,077	2,764	37,789

In the cases of the Chinese, the Japanese, the Hindus, the Malays, and the "others," persons under the age of 15 represented less than 6 per cent. of the total, while amongst Syrians about 35 per cent., and amongst Polynesians about 20 per cent. of the total were under 15.

Amongst Chinese, Syrians, and Polynesians approximately 50 per cent. were in the age group of 15-44, while in the case of the Japanese no fewer than 93 per cent. were of tha age, the corresponding proportions in the other cases being Hindus 76 per cent., Malays 80 per cent. and "others," 69 per cent.

In the group 45-64 were 38 per cent. of the Chinese, and  $31\frac{1}{2}$  per cent. of the Polynesians, but only  $5\frac{1}{2}$  per cent. of the Japanese.

The age group 65 and over contained  $7\frac{3}{4}$  per cent. of the Chinese total, but relatively small proportions of the other races, and less than 2 per 1000 in the case of the Japanese.

A similar summary relative to the half-caste population is given in the following table:—

Ages of Non-European Half-castes, Commonwealth, 1911.

A <sub>ξ</sub>	gө.		Aust. Abgnls.	Chinese	Hindus.	Negroes	Poly- nesians	Japan- ese.	Syrians.	Malays.	Others.	Total Half- caste.
	-					MALES.						
Under 15			2,194	691	151	51	63	32	. 34	19	73	3,308
15-44			2,551	786	68	97	32	13	6	14	44	3,611
45-64			460	41	16	39	4	6	"	5	12	583
65 and over			78		4	4	••				4	90
TOTAL		• •	5,283	1,518	239	191	99	51	40	38	133	7,592
			_			FEMAL	ES.		<u> </u>			
Under 15			2,255	699	113	52	45	29	39	32	77	3,341
15-44			2,219	748	37	83	28	6	5	14	42	3,182
45-64			298	51	6	9	2	i	"		5	372
65 and over			58	3	4	ĭ			::		ĭ	67
TOTAL			4,830	1,501	160	145	75	36	44	46	125	6,962
1					<u>.</u>	PERSON	ıs.				,	
Under 15			4,449	1,390	264	103	108	61	73	51	150	6,649
15-44	• •	• •	4,770	1,534	105	180	60	19	11	28	$\begin{array}{c} 150 \\ 86 \end{array}$	6,793
45-64	• •	• •	758	92	22	48	6	19 7		5	17	955
65 and over	• •	• •	136	3	8	5		'	•••		5	157
TOTAL			10,113	3,019	399	336	174	87	84	84	258	14,554

6. British Subjects.—Of the Non-Europeans of full-blood about one-third were returned as being British subjects, whilst of the half-castes practically all were British subjects by birth-place. The figures for persons of full-blood of the principal races are as follows:—

Race and Nationality, Commonwealth, 1911 [Full-blood].

Nationality.	Chinese.	Japan- ese.	Hindus.	Syrians,	Poly- nesians.	Malays.	Others.	Total, Non European Races.
			MALES.					
British Subject by— Birthplace	1,168 65 3,259 17,364 21,856	29  92 3,160 3,281	3,003 18 18 162 3,201	404 11 406 476	602 115 166 821	625 3 20 385	1,055 60 161 1,284 2,560	6,886 272 4,122 23,652 34,932
			EMALES					
		<del>,                                    </del>		'•	1			1
British Subject by— Birthplace Parentage Naturalization Foreign Subject	643 3 49 202	30 1 13 164	92 6	446 10 218 368	285 7 8 64	39	158 4 6 36	1,693 31 298 835
TOTAL	897	208	98	1,042	364	44	204	2,857
		P	ERSONS					
British Subject by— Birthplace	1,811 68 3,308 17,566	59 1 105 3,324	3,095 24 18 162	850 21 624 844	887 122 174 885	664 3 24 386	1,213 64 167 1,320	8,579 303 4,420 24,487
TOTAL	22,753	3,489	3,299	2,339	2,068	1,077	2,764	37,789

Of the total of 37,789 persons of Non-European race, 8579, or 22.7 per cent., were British subjects by birthplace; 303, or 0.8 per cent., were British subjects by parentage; and 4420, or 11.7 per cent., were British subjects by naturalization; the balance of 24,487, or 64.8 per cent., being foreign subjects.

Of the 8579 who were British by birthplace, 3442, or 40 per cent., had been born in the

Commonwealth.

Similar particulars in respect of the principal half-caste members of the community were as follows:—

Nationality of Non-European Half-castes, Commonwealth, 1911.

Nationality.	Aust. Abgnls.	Chinese	Hindus	Negroes	Poly- nesians.	Japan- ese.	Syrians	. Malays.	Others.	Total Half- caste
			N	IALES.						
British Subject by— Birthplace Parentage Naturalization Foreign Subject		1,511 2 2 2 3	231 5 	168 7 8 8	90 3 3 3	46  1 4	38 1 	34 1 	122 2  9	7,523 21 14 34
TOTAL	5,283	1,518	239	191	99	51	40	38	133	7,592
			F	EMALES	š					
British Subject by— Birthplace Parentage Naturalization Foreign Subject	4,829   1	1,494	160	142 1 	70 3 	36	41  2 1	46	121 2 	6,939 6 2 15
Total	4,830	1,501	160	145	75	36	44	46	125	6,962
				PERSON	rs.	-				
British Subject by— Birthplace Parentage Naturalization Foreign Subject	10,112	3,005 2 2 10	391 5 3	310 8 8 10	160 6 3 5	82	79 1 2 2	80 1 3	243 4  11	14,462 27 16 49
TOTAL	10,113	3,019	399	336	174	87	84	84	258	14,554

Of the total of 14,554 half-castes, no fewer than 14,462, or 99.4 per cent., were British by birthplace. Of those who were British by birthplace, 14,287, or nearly 99 per cent., had been born in the Commonwealth.

7. Length of Residence.—In the case of Non-Europeans of the full-blood, 3442, or about 9 per cent. of the total had been born in Australia, while of the remainder, 14,273, or nearly 38 per cent. of the total had been in Australia for 20 years or over. The remaining 20,074, or about 53 per cent. of the total, had consequently arrived in the Commonwealth in 1891 or subsequent years. Particulars for the principal races are as follows:—

Race and Length of Residence, Commonwealth, 1911 [Full-blood].

Length of Residence.	Chinese.	Japan- ese.	Hindus.	Syrians.	Poly- nesians.	Malays.	Others.	Total, Non European Races
			MALES.		5176 - Marie			
Under 20 Years	00.5	3,148 107 26	2,711 405 85	633 255 409	219 1,161 324	768 221 44	1,703 732 125	19,143 13,941 1,848
TOTAL	. 21,856	3,281	3,201	1,297	1,704	1,033	2,560	34,932
		F	EMALES	<u> </u>				
20 Years and over	. 172 . 89 . 636	175 4 29	11 21 66	499 98 445	30 69 265	2 6 36	42 45 117	
TOTAL	. 897	208	98	1,042	364	44	204	2,857
		I	PERSONS	3.				
20 Years and over	. 10,133 . 11,149 . 1,471	3,323 111 55	2,722 426 151	1,132 353 854	249 1,230 589	770 227 80	1,745 777 242	14,273
TOTAL	. 22,753	3,489	3,299	2,339	2,068	1,077	2,764	37,789

This table furnishes evidence of a relatively heavy influx of Japanese, Hindus, Syrians and Malays during the 20 years preceding the Census, and a marked falling-off in the number of Polynesians during the same period. The latter is largely due to the deportation of Kanakas from Queensland, and the extension of the White Australia principle to the sugar industry of that State. More than 52 per cent. of the immigrant Chinese had been resident in Australia for upwards of 20 years.

For the half-castes the corresponding particulars are as follows:—

Length of Residence of Half-caste Non-Europeans, Commonwealth, 1911.

Length of Residence.	Aust. Abgnls.	Chinese	Hindus.	Negroes	Poly- nesians.	Japan- ese.	Syrians	Malays.	Others.	Total Half- caste.
			N	IALES.						
Under 20 Years . 20 Years and over . Australian Born .		5 3 1,510	41 20 178	29 33 129	13 5 81	$\begin{array}{c} 3\\2\\46\end{array}$	6  34	1 5 32	17 20 96	117 88 7,387
Total	. 5,283	1,518	239	191	99	51	40	38	133	7,592
			F	EMALE	S.					
Under 20 Years . 20 Years and over . Australian Born .		5 3 1,493	4 12 144	3 6 136	$\begin{array}{ccc} . & 3 & \\ & 6 & \\ & 66 & \end{array}$	  36	$egin{pmatrix} 2 \\ 1 \\ 41 \end{bmatrix}$	  46	9 7 109	$\begin{array}{c} 27 \\ 35 \\ 6,900 \end{array}$
Total	. 4,830	1,501	160	145	75	36	44	46	125	6,962
	· · · · · · · · · · · · · · · · · · ·		F	PERSON	S.					
Under 20 Years . 20 Years and over . Australian Born .	10.110	10 6 3,003	$\begin{array}{c} 45 \\ 32 \\ 322 \end{array}$	32 39 265	16 11 147	3 2 82	8 1 75	1 5 78	$\begin{array}{c} 26 \\ 27 \\ 205 \end{array}$	144 123 14,287
Total	. 10,113	3,019	399	336	174	87	84	84	258	14,554

The total number of immigrant half-castes was only 267, of whom 144, or 54 per cent., had been resident in Australia for less than 20 years, and 123, or 46 per cent., for 20 years and over.

8. **Education.**—Classified according to ability to read and write English or a Foreign language, the education of the Non-Europeans of the full-blood was as follows:—

Race and Education, Commonwealth, 1911:—Population aged 5 and upwards [Full-blood].

Education.	Chinese.	Japan- ese.	Hindus.	Syrians.	Poly- nesians.	Malays.	Others.	Total, Non- European Races.
			MALES.	7			<u> </u>	
English Language								
Read and Write Read only	3,491 58	621 6	566 14	693 11	462 104	126	757 15	6,716 208
Foreign Language only-	10.000	0.000	077	010	4-	000		10.050
Read and Write Read only	12,362 1,443	2,260 170	977 148	$\begin{array}{c} 210 \\ 34 \end{array}$	45	332 44	492 26	16,678 1,871
Cannot Read	4,278	209	1,467	184	988	515	1,232	8,873
Total	21,632	3,266	3,172	1,132	1,605	1,017	2,522	34,346
		]	FEMALE	S.	1	·		
English Language—			!		i I			
Read and Write	424	47	49	476	175	15	126	1,312
Read only	2		1	10	5		٠,٠	18
Foreign Language only—								
Read and Write .:	108	118	4	112	6		5	353
Read only	8	3		22	2		2	37
Cannot Read	149	33	18	261	104	23	33	621
TOTAL	691	201	72	881	292	38	166	2,341
	1		PERSON	S.	1	1		
TO THE TAX				1				
English Language— Read and Write	3,915	668	615	1,169	637	141	883	8,028
Danillar	3,913	6	15	21	109		15	226
Foreign Language only—	1 30	"	10	21	103	•••	10	1 220
Read and Write	12,470	2,378	981	322	51	332	497	17,031
Read only	1,451	173	148	56	8	44	28	1,908
Cannot Read	4,427	242	1,485	445	1,092	538	1,265	9,494
TOTAL	22,323	3,467	3,244	2,013	1,897	1,055	2,688	36,687

Of 36,687 persons of Non-European race aged 5 years and upwards, 8028, or about 22 per cent., were able to read and write English, and 17,031, or about  $46\frac{1}{2}$  per cent. were able to read and write in a Foreign language, but not in English. The number unable to read either English or a Foreign language was 9494, or about 26 per cent. of the total aged 5 and upwards.

The following table furnishes for each of the races specified the percentage of persons aged 5 years and upwards who were recorded as unable to read:—

Percentage of Non-Europeans aged 5 and upwards unable to Read, Commonwealth, 1911 [Full-blood].

	Partic	ulars.		Chinese.	Japan- ese.	Hindus.	Syrians.	Poly- nesians.	Malays.	Others.	Total, Non- European Races.
Males Females			• •	19.78 $21.56$	$\frac{\%}{6.40}$ $16.42$	$\frac{\%}{46.25}$ $25.00$	$^{\%}_{16.25}$ $^{29.63}$	$\frac{\%}{61.56}$ $35.62$	% 50.64 60.53	% 48.85 19.88	% 25.83 26.53
Pers	sons	••		19.83	6.98	45.78	22.11	57.56	51.00	47.06	25.88

The Japanese and Chinese furnished the smallest and the Malays and Polynesians the highest proportions of persons above the age of 5 unable to read.

For the half-caste population, the particulars in respect of education were as follows:-

Education of Half-castes aged 5 and upwards, Commonwealth, 1911.

Education.	Aust. Abgnls.	Chinese	Hindus	Negroes	Poly- nesians	Japan- ese.	Syrians	Malays	Others	Total Half- caste
				MALE	S.					
English Language— Read and Write Read only Foreign Language only—	2,719 64	1,183 4	131 	154 4	70 1	<b>3</b> 0	20	26 	76 1	4,4 <b>0</b> 9 74
Read and Write	·	4	5	1	1	5		. 1	10	27
Read only		1		••			::		5	6
Cannot Read	1,692	64	28	14	9		1	6	9	1,823
TOTAL	4,475	1,256	164	173	81	35	21	33	101	6,339
	<del> </del>			7	<u>-</u>		'			
				FEMALI	18.					
English Language— Read and Write Read only	2,629 46	1,194	97 1	125 2	48	23	22	29 	79 	4,246 49
Foreign Language only— Read and Write	-[		,		, !					
Read and Write Read only			. 1	• •	1					11
Cannot Read	1,330	41	15	4	13	• •		8		1,414
TOTAL	4,005	1,236	114	131	62	23	22	37	90	5,720
		·		PERSO	MC.			ŀ		1
	<del>,</del>			I EIVSO	110.	<u>:</u>				
English Language— Read and Write Read only Foreign Language only—	5,348 110	2,377	228 1	279 6	118 1	53 · ·	42	55 	155 1	8,655 123
Read and Write	·	5	6	1	2	5		1	18	38
Read only Cannot Read	3,022	1 105	43	 18	22		1	14	5 12	3,237
TOTAL	8,480	2,492	278	304	143	58	43	70	191	12,059

Of 12,059 half-castes aged 5 years and upwards, 8655, or nearly 72 per cent., were able to read and write English, while 3237, or nearly 27 per cent, could not read.

The succeeding table shews for each of the races specified the percentage of half-castes aged 5 years and upwards who were recorded as unable to read.

Percentage of Half-castes aged 5 and upwards unable to Read, Commonwealth, 1911.

Partic	ulars.	Aust. Abgnls.	Chinese	Hindus	Negroes	Poly- nesians	Japan- ese.	Syrians	Malays	Others	Total, Half- caste.
Males Females		 37 81 33.21	$5.10 \\ 3.32$	% 17.07 13.16	$\frac{\%}{8.09}$	$\frac{\%}{11.11}$ 20.97	.00 .00	4.76 .00	$^{\%}_{18.18}_{21.62}$	% 8.91 3.33	28.76 $24.72$
Persons	••	 35.64	4.21	15.47	5.92	15.38	.00	2.33	20.00	6.28	26.84

All the Japanese half-castes above the age of 5 were returned as able to read and write, and only 2.33 per cent. of the Syrian, and 4.21 per cent. of the Chinese half-castes above that age were returned as being unable to read.

9. **Conjugal Condition.**—Particulars in respect of each race were tabulated with regard to conjugal condition. For the Commonwealth the details in respect of full-blood Non-Europeans are as follows:—

Race and Conjugal Condition, Commonwealth. 1911, Population aged 15 and upwards (Full-blood).

Conjug	al Co	ondition	1.	Chinese.	Japan- ese.	Hindus.	Syrians.	Poly- nesians.	Malays.	Others.	Total, Non European Races.
						MALES.					
Married Never Marr	ied			8,032 12,860	392 2,837	1,137 1,776	520 369	371 1,042	102 870	407 1,983	10,961 21,737
Widowed Divorced	• •	••	• •	374 11	25 5	217	18 2	60 4	18 4	84	796 33
TOTAL	••		• •	21,277	3,259	3,133	909	1,477	994	2,478	33,527
-						FEMALE	s.				
Married Never Marr Widowed	ied			314 66 18	108 70 4	36 12 5	446 107 63	134 43 7	17 3	73 36 13	1,128 337 110
Divorced					î	••	l	i	•••		3
TOTAL				398	183	53	617	185	20	122	1,578
					P	ERSONS	•				
Married Never Marr Widowed Divorced	ied			8,346 12,926 392 11	500 2,907 29 6	1,173 1,788 222 3	966 476 81 3	505 1,085 67 5	119 873 18 4	480 2,019 97 4	12,089 22,074 906 36
TOTAL				21,675	3,442	3,186	1,526	1,662	1,014	2,600	35,105

Of 35,105 persons of Non-European race aged 15 years and upwards, 12,089, or  $34\frac{1}{2}$  per cent., were married; 22,074, or about 63 per cent., had never been married; 906, or about  $2\frac{1}{2}$  per cent., were widowed; and 36, or about 1 per thousand, were divorced.

The percentage of the full-blood Non-Europeans aged 15 years and upwards who were married at the date of the Census is shewn in the next table, the particulars being given separately for each race and sex:—

Percentage Married amongst those aged 15 and upwards, Commonwealth, 1911 [Full-blood].

	Particul	ars.	-	Chinese.	Japan- ese.	Hindus.	Syrians.	Poly- nesians.	Malays.	Others.	Total, Non- European Races.
Males				% 37.75	12.03	% 36.29	57.21	25.12	% 10.26	16.42	% 32.69
Females	• •	• •	• •	78.89	59.02	67.92	72.29	72.43	85.00	59.84	71.48
Pers	ONS	• •	• •	38.51	14.53	36.82	63.30	30.39	11.74	18.46	34.44

The Syrians furnished the highest, and the Malays the lowest proportion of married men, while the Malays furnished the highest, and the Japanese the lowest proportion of married women. In all cases the proportion of women married was very much higher than the proportion of men.

For the half-caste population the particulars in respect of Conjugal Condition were as follows:—  $\,$ 

Conjugal Condition of Half-castes aged 15 and upwards, Commonwealth, 1911.

Conjugal Con	nditi	on.	Aust. Abgnls.	Chinese	Hindus	Negroes	Poly- nesians	Japan- ese.	Syrians	Malays	Others	Total, Half- caste.
						MALES	•					
Married Never Married Widowed			1,168 1,800 115	230 590 6	41 37 10	61 72 7	14  22	$\begin{array}{c} 6 \\ 11 \\ 2 \end{array}$	6	17	24 32 4	1,546 2,565 166
Divorced	• •		6	1						::		7
TOTAL	• •		3,089	827	88	140	36	19	6	19	60	4,284
					]	FEMALE	s.					
Married Never Married Widowed Divorced	•••		1,421 1,033 118 3	$\begin{array}{r} 373 \\ 403 \\ 25 \\ 1 \end{array}$	24 18 5	40 47 5 1	13 15 1 1	2 5 	5	8 5 1	36 8 4	1,917 1,539 159 6
Total			2,575	802	47	93	30	7	5	14	48	3,621
					1	PERSON	S.	<u> </u>				
Married Never Married Widowed Divorced	••		2,589 2,833 233 9	603 993 31 2	65 55 15	101 119 12 1	27 15 23 1	8 16 2	il	10 22 1	60 40 8	3,463 4,104 325 13
TOTAL			5,664	1,629	135	233	66	26	11	33	108	7,905

Of 7905 half-castes aged 15 and upwards, 3463, or nearly 44 per cent., were married; 4104, or nearly 52 per cent., had never been married; while 325, or more than 4 per cent., were widowed; and 13, or  $1\frac{3}{4}$  per thousand, were divorced.

The next table shews the proportion per cent. of the half-castes aged 15 years and upwards who were married at the date of the Census.

Percentage Married amongst those aged 15 and upwards, Commonwealth, 1911 [Half-castes].

Partie	males			Chinese	Hindus	Negroes	Poly- nesians	Japan- ese.	Syrians	Malays	Others	Total, Half- caste.
Males Females			% 37.81 55.18	27.81 46.51	% 46.59 51.06	43.57 43.01	% 38.89 43.33	$\frac{\%}{31.58}$ $28.57$	.00 .00	$\frac{\%}{10.53}$ $57.14$	$\frac{\%}{40.00}$ $75.00$	$\begin{array}{r} \% \\ 36.09 \\ 52.94 \end{array}$
Persons			45.71	37.02	48.15	43.35	40.91	30.77	.00	30.30	55.56	43.81

Of the races specified, the Hindus furnished the highest, and the Syrians the lowest proportion of males married, while the Malays furnished the highest, and the Syrians the lowest proportion of females married. The number of Syrian half-castes married was nil.

10. Birthplace.—Details respecting the birthplaces of the representatives of the various races are given on pp. 974 to 1013 of Vol. II. Census Detailed Tables. A summary of the data for full-blood Non-Europeans for the Continental divisions of birthplaces is as follows:-

Birthplace and Race, Commonwealth, 1911 [Full-blood].

Bir	Birthplace.				Japan- ese.	Hindus.	Syrians.	Poly- nesians.	Malays.	Others.	Total, Non European Races.
						MALES.					
Australasia				835	26	85	404	327	44	181	1,902
Europe				5			26	1		5	36
Asia				21,000	3,253	3,101	854	9	987	1,656	30,860
Africa					1	4	9		1	97	112
America				13		. 1	4	2		247	267
Polynesia				1	1	8		1,365	1	374	1,750
At Sea	• •	• •		2	••	2		1			5
TOTAL				21,856	3,281	3,201	1,297	1,704	1,033	2,560	34,932
						FEMALE	S.				
Australasia				636	29	68	446	265	36	139	1,619
Europe					2		11			i	14
Asia				260	177	23	578		8	29	1,075
Africa						.,	6		l ·	6	12
America				1					l	21	22
Polynesia						7	1	99		8	114
At Sea							1	••			1
Total				897	208	98	1,042	364	44	204	2,857

Birthplace and Race, Commonwealth, 1911 (Full-blood).—continued.

В	irthp	lace.		Chinese.	Japan- ese.	Hindus.	Syrians.	Poly- nesians.	Malays.	Others.	Total, Nor European Races.
					-	PERSON	S.				
Australasia				1,471	55	153	850	592	80	320	3,521
Europe				5	2		37			6	50
Asia				21,260	3,430	3,124	1,432	9	995	1,685	31,935
Africa			٠.		1	4	15		1	103	124
America				14		1	4	2		268	289
Polynesia				1	1	15		1,464	1	382	1,864
At Sea	• •			2	• •	2	1	1	••		6
TOTAL				22,753	3,489	3,299	2,339	2,068	1,077	2,764	37,789

Of the total of 37,789 persons of Non-European race, 31,935, or  $84\frac{1}{2}$  per cent., had been born in Asia; 3521, or  $9\frac{1}{4}$  per cent., in Australasia; and 1864, or 5 per cent., in Polynesia; all other highlages accounting for only 469, or  $1\frac{1}{4}$  per cent. of the total

all other birthplaces accounting for only 469, or  $1\frac{1}{4}$  per cent., of the total.

The race which was proportionately most largely born in Australasia was the Syrian, no fewer than 850 out of a total of 2339 being so born. This represented a proportion of no less than 36 per cent. In the case of the Japanese on the other hand, the proportion born in Australasia was only about  $1\frac{1}{2}$  per cent. of the total.

A similar summary in respect of half-castes is furnished in the succeeding table :-

Birthplaces of Half-castes, Commonwealth, 1911.

Birth	place.		Aust. Abgnls.	Chinese	Hindus	Negroes	Poly- nesians	Japan- ese.	Syrians	Malays	Others	Total Half- caste.
					N	ALES.				~ ~~		
Australasia			5,281	1,510	178	131	82	46	38	33	113	7,412
Europe				i '	1	3					<b>2</b>	6
Asia				7	56			4	2	5	5	79
Africa				! . <b>.</b>		11					4	15
America				i !	2	44		1			7	54
Polynesia			1	1		)	16				<b>2</b>	20
At Sea			1		2	2	1				• •	6
TOTAL			5,283	1,518	239	191	99	51	40	38	133	7,592
-				· ,	F	EMALE	S.					
Australasia			4,829	1,494	144	137	66	36	41	46	117	6,910
Europe		• •	'	2	l	i - 1				-		3
Asia	• •	• •		5	15	• •				••		27
Africa	• •	• •		- 1						••	ì	2
America		• •		• •		6			•••	• •	î	7
Polynesia		• •	1		• •	1		• •		•••	$\overset{1}{2}$	13
At Sea	• •	• •			• •				• • •	• •		
TOTAL			4,830	1,501	160	145	75	36	44	46	125	6,962
	)		<u> </u>			PERSO	NS.		,			
Australasia			10.110	3,004	322	268	148	82	79	79	230	$\begin{vmatrix} 14.322 \end{vmatrix}$
Europe			10,110	2,004	2	3					230	9
Asia	• •	• •	::	12	71	_		4	5		9	106
Africa			::-			12			"		5	17
America	• •		::		2	50		1	:.		8	61
Polynesia	• • •	• •	2	1		1	25			• • •	4	33
At Sea	• •	• •	ĩ		2	2	1			•••		6
TOTAL			10,113	3,019	399	336	174	87	84	84	258	14,554

Of the total of 14,554 half-castes, no fewer than 14,322, or about  $98\frac{1}{2}$  per cent., were born in Australasia, Asia being represented by only 106, and America by 61.

11. Occupation—Full-blood Males.—(i.) General. On pp. 1014 to 1071 of Vol. II. Census Detailed Tables, extensive particulars are given concerning the occupations of persons of Non-European race. These particulars are furnished for each sex separately, being given for the Commonwealth in accordance with the extended classification of occupations, and for the States and Territories in accordance with the summarised classification used on the present occasion.

In the summarised form the Commonwealth particulars for males of the full-blood of the principal races are as follows, persons of unspecified occupation having been uniformly distributed. Commonwealth Census, 1911.—Full-blood Males of Non-European Race, classified according to Occupation.

		Occupation.				RACE	C.			
Order	Sub- order	Designation.	Chinese.	Japanese.	Hindus.	Syrians.	Polyn'sians	Malays.	Others.	Total Non- European Races.
$\frac{1}{2}$		CLASS I.—PROFESSIONAL. Engaged in Government, Defence, Law, etc. Ministering to Religion, Charity, Health, Education, etc	19 135	6 28	1-	1	2 25		5 69	34 307
		TOTALCLASS I	154	34		16	27	2	74	341
3	1 2	CLASS II.—Domestic. Engaged in supplying Board and Lodging , Domestic Service and Attendance	655 1,312	241 359	21 57	9	13 77	12 20	86 111	1,037 1,939
÷		TOTAL—CLASS II	1,967	600	78	12	90	32	197	2,976
4 5 6		CLASS III.—COMMERCIAL.  Dealing in Property and Finance  ,, Art and Mechanic Productions ,, Textile Fabrics, Dress and Fibrous Materials	9 16 115		3 3 81	2 9 141		••	3 11 9	$\begin{array}{c} 20 \\ 42 \\ 352 \end{array}$
7		,, Food, Drinks, Narcotics, and Stimulants		_		45	5		26	-
8		,, Animals, Animal and Vegetable Substances, N.E.I	65	2	18	19		1	12	117
$9 \\ 10 \\ 11 \\ 12 \\ 13$		" Fuel and Light " Metals and Other Minerals General and Undefined Merchants & Dealers Speculators on Chance Events	1,717 5	57	5 5 714 	$1 \\ 3 \\ 455 \\ 1 \\ \dots$	1  7 	  8	$\begin{array}{c} \cdot \cdot \cdot \\ 4 \\ 72 \\ 1 \end{array}$	13 14 3,030 7
10		Total—Class III	3,532		877	676	16		138	
14	1 2	CLASS IV.—TRANSPORT AND COMMUNICATION. Engaged in Railway Traffic Traffic on Roads	24	2		1	4		5 171	314
	3 4 & 5	" " " Seas and Rivers " Postal, Telegraph & Telephone Service	917	130	1,296	2	22 1		221 1	2,717
	6	Messengers, etc			••					
		TOTAL—CLASS IV CLASS V.—INDUSTRIAL.	946	132	1,408	4	27	130	398	3,045
15 16		Working in Art and Mechanic Productions ,, Textile Fabrics, Dress, and Fibr-	1,955		1			1	22	
17		ous Materials Food, Drinks, Narcotics, and	80 170			48 3			10 80	
18		Stimulants ,, Animal and Vegetable Sub- stances, N.E.I	3	i		3 1	18	6	15	
$\begin{array}{c} 19 \\ 20 \end{array}$		,, Metals and Other Minerals ,, Fuel, Light and other forms of	14	4	1	18	••	٠.	12	53
21		Energy Engaged in Construction of Buildings, Roads, Railways, etc	1 100	:	6	9		,	1 18	
$\begin{array}{c} 22 \\ 23 \end{array}$		", Disposal of Dead or of Refuse ", Undefined Industrial Pursuits	384			11	ii7	1	70	3
		TOTAL—CLASS V	2,709	316	122	108	178	40	228	3,701
24	1 2 3	CLASS VI.—PRIMARY PRODUCERS. Engaged in Agricultural Pursuits Pastoral Pursuits Capture, etc., of Wild Animals	9,125 939			47 18		139 21	93	,
	<b>4</b> 5	and their Produce ,, Fisheries ,, Forestry	$\begin{array}{c c} & 1\\ & 117\\ & 25 \end{array}$	1,866 22		2 1	3 117 46	1	$\begin{vmatrix} 1,008 \\ 36 \end{vmatrix}$	
	<b>6</b> 7	,, Water Conservation & Supply ,, Mining and Quarrying	11 1,598	1		10	13	2	7	21
		Total—Class VI	11,816	2,098	603	78	1,129	777	1,421	17,922
<b>2</b> 5		CLASS VII.—INDEPENDENT	16		5		1		7	29
		Total—Breadwinners	21,140	3,257	3,127	894	1,468	995	2,463	33,344
26 27	1	CLASS VIII.—DEPENDENTS.  Dependent on Natural Guardians  Supported by Voluntary or State Contribu-	602	23	62	401	227	38	83	1,436
	2	tions	109				8 1		12 2	
		TOTAL—CLASS VIII	716	24	74	403	236	38	97	1,588
		GRAND TOTAL	21,856	3,281	3,201	1,297	1,704	1,033	2,560	34,932

- (ii.) Chinese. Of the total of 21,856 Chinese males, 21,140 or nearly 97 per cent., were breadwinners, of whom more than half were employed as primary producers. Agricultural pursuits accounted for 9125, of whom 7315 were market gardeners. The number employed in industrial pursuits was 2709, of whom no fewer than 1926 were engaged in the manufacture of furniture. Merchants, storekeepers, and dealers undefined accounted for 1717, while dealers in food, drinks, narcotics, and stimulants totalled 1597. Included in this latter were 1220 greengrocers and fruiterers, and 217 grocers. The total employed in mining was 1598, of whom by far the greater number were engaged in gold and tin mining. The total engaged in domestic service and attendance was 1312, of whom 622 were laundrymen, and 590 were house servants. In pastoral pursuits 939 were employed, of whom 856 were station hands. Traffic on seas and rivers accounted for 917, mainly employed as seamen, stokers, stewards and ships' servants. The only other large group was that of 655 employed in supplying board and lodging. These consisted mainly of cooks and other servants employed in hotels, coffee palaces, restaurants, boarding houses, etc.
- (iii.) Japanese. Of the total of 3281 male Japanese of the full-blood, no fewer than 3257, or more than 99 per cent., were breadwinners. The occupation most largely represented was that of pearlshell fisher, the total so employed being 1833, or 56 per cent. of the total. The only other occupations at all extensively represented were those of "domestic service and attendance" 359, mainly laundrymen and house servants, and "supplying board and lodging" 241, mainly hotel, restaurant and boarding house servants.
- (iv.) *Hindus*. The term Hindu has been here applied to all native races of India. Of the total of 3201 male Hindus of the full-blood, 3127, or nearly 98 per cent., were breadwinners. The occupations most largely represented were those connected with shipping, the number so employed being 1296, consisting mainly of seamen, stokers, stewards and ship servants. The group of merchants and dealers undefined comprised 714, of whom 554 were hawkers. There were 366 engaged in agricultural pursuits, mainly as farmers and sugar planters' hands, and 201 in pastoral pursuits, mainly in connexion with dairying. The only other group of any extent was that of 111 teamsters, more than half of whom were in Western Australia.
- (v.) Syrians. The Syrian male population contained a relatively large proportion of dependents, the breadwinners being 894 out of 1297, or only 69 per cent. of the total. The occupation most largely represented was that of merchant and dealer undefined, representing a total of 455, and consisting mainly of general storekeepers and hawkers. The sale and manufacture of textile fabrics and dress accounted between them for 189, mainly drapers and tailors, while agricultural pursuits were represented by 47, and the sale of food and drink by 45, the latter consisting mainly of greengrocers, fruiterers and grocers.
- (vi.) Polynesians. In the case of the Polynesian males also there was a fairly large proportion of dependents, the breadwinners comprising 1468, or only 86 per cent., of the total of 1704. The occupations most largely represented were those connected with agricultural pursuits, no fewer than 837, or 57 per cent., of the breadwinners being so engaged. Of these 410 were employed as farmers, and farm hands, and 244 in sugar planting, 117 were returned as labourer undefined, while fisheries accounted for 117, pastoral pursuits for 113, and domestic occupations for 90.
- (vii.) Malays. Of the total of 1033 male Malays of the full-blood, 995, or 96 per cent., were breadwinners. The occupation most largely represented was that of pearlshell fishing, the number so employed being 581, or 58 per cent., of the breadwinners. The only other occupations largely represented were agricultural pursuits with 139, and shipping with 129.
- (viii.) Other Races. The full-blood males of other Non-European races than those enumerated above totalled 2560, of whom 2463, or 96 per cent., were breadwinners. These were mainly employed (a) as pearlshell fishers, principally Papuans, Filipinos, Timorese, and Javanese; (b) in agricultural pursuits, mainly Javanese and Cingalese; (c) in shipping, mainly Timorese and Javanese; (d) as teamsters, mainly Afghans, and (e) in domestic occupations, mainly Cingalese and Negroes.
- (ix.) All Races. Taking all the Non-European males together, it may be said that of the total of 34,932 there were 33,344 breadwinners, or about  $95\frac{1}{2}$  per cent. of the total. Of these 10,900 were engaged in agricultural pursuits, mainly market gardening; 5330 in commercial pursuits, mainly as storekeepers and assistants, and as hawkers; 3720 in fisheries, mainly as pearlers; 3701 in industrial pursuits, mainly the manufacture of furniture; 2976 in domestic occupations, mainly as laundrymen and house servants; 2717 in connexion with shipping; 1689 as miners, mainly gold and tin; and 1426 in pastoral pursuits.
- 12. Occupation—Full-blood Females.—The succeeding table furnishes corresponding figures for females of the full-blood races as specified:—

# Commonwealth Census, 1911.—Full-blood Females of Non-European Race, classified according to Occupation.

	Occupation.				RACE.						
Order	Sub- order	Designation.	Chinese.	Japanese.	Hindus.	Syrians.	Polyn'sians	Malays.	Others.	Total Non- European Races.	
1		CLASS I.—PROFESSIONAL. Engaged in Government, Defence, Law, etc.	1					:		1	
2		Ministering to Religion, Charity, Health, Education, etc.	4			2	2		13	22	
		Total—Class I	5	•••	1	2	2		13	23	
3	1 2	CLASS II.—DOMESTIC. Engaged in supplying Board and Lodging ,, Domestic Service and Attendance	1 19	6 36	1 7		1 37	2	8 22	18 136	
		Total—Class II	20	42	8	14	38	2	30	154	
4 5		CLASS III.—COMMERCIAL.  Dealing in Property and Finance  Art and Mechanic Productions	1		•••					4	
6		" Textile Fabrics, Dress and Fibrous Materials				39		• •		39	
7 8		,, Food, Drinks, Narcotics, and Stimulants	6	5		3				14	
9		,, Animals, Animal and Vegetable Substances, N.E.I				1				1	
10 11 12		,, Metals and Other Minerals General and Undefined Merchants & Dealers			  1	71		•••	  1		
13		Speculators on Chance Events Engaged in Storage	··. 		··-		•••	•••	•••	•••	
		TOTAL—CLASS III	17	10	1	115	•••		1	144	
14	1 2	CLASS IV.—TRANSPORT AND COMMUNICATION, Engaged in Railway Traffic ,, Traffic on Roads	• •								
	3 4 & 5	", ", Seas and Rivers ", Postal, Telegraph & Telephone		••	• •		•••			••	
	6	Service	1		• •				• •	1	
		Total—Class IV	1			••				1	
15 16		CLASS V.—INDUSTRIAL. Working in Art and Mechanic Productions ,, Textile Fabrics, Dress, and Fib-	1						•••	1	
17		rous Materials ,, Food, Drinks, Narcotics, and Stimulants	18 1	21	4	<b>68</b> 1		!	2	113 3	
18		,, Animal and Vegetable Substances, N.E.I.						••	1	1	
19 20		" Metals and Other Minerals " Fuel, Light and other forms of Energy	1	••	••	• •		••	••	. 1	
21		Engaged in Construction of Buildings, Roads, Railways, etc.								• •	
22 23		", Disposal of Dead or of Refuse," Undefined Industrial Pursuits	• •			1			• •		
		TOTAL—CLASS V	21	21	4	70	••		4	120	
24	,1 2	CLASS VI.—PRIMARY PRODUCERS. Engaged in Agricultural Pursuits		1	1 1	2 1		••		8 2	
	3	,, Capture, etc., of Wild Animals and their Produce									
	4 5	" Fisheries	••	• •	• •				• •	• •	
	6 7	" Water Conservation & Supply " Mining and Quarrying			• •		• •	••	• •	• •	
		TOTAL—CLASS VI	1	1	2	3	3			10	
25		CLASS VII.—INDEPENDENT		•••	••	1		••	1	2	
		Total-Breadwinners	65	74	16	205	43	2	49	454	
26 27	1	CLASS VIII.—DEPENDENTS. Dependent on Natural Guardians Supported by Voluntary or State Contribu-	831	133	82	837	319	42	155	2,399	
	2	tions	1				2			3 1	
		TOTAL—CLASS VIII	832	134	82	837	321	42	155	<b>2,4</b> 03	
		Grand Total	897	208	98	1,042	364	44	204	2,857	

Of the total of 2857 Non-European females of the full-blood, only 454, or about 16 per cent., were breadwinners, the largest number of breadwinners, viz., 205, occurring in the case of the Syrians, and the largest proportion, viz., 36 per cent., in the case of the Japanese. The occupations in which the largest numbers were employed were those of house servants, laundresses, storekeepers, hawkers, and dressmakers.

13. Occupations.—Male Half-castes.—(i.) General. Similar particulars for the male half-castes are given in the following table for the Commonwealth as a whole:—

Commonwealth Census, 1911.—Half-caste Males of Non-European Race, classified according to Occupation.

		OCCUPATION.					Raci	C.				n- aces.
Order	Sub- order	Designation.	Australian Aboriginals	Chinese.	Hindus.	Negroes.	Polyn'sians	Japanese.	Syrians.	Malays.	Others.	Total Non- European Races.
1 2		CLASS I.—PROFESSIONAL. Engaged in Government, Defence, Law, etc. Ministering to Religion, Charity, Health,	27	13	1	1		1				43
		Education, etc	29	19		6	• •	1	1	1	5	<b>62</b>
		Total—Class I	<b>5</b> 6	32	1	7		2	1	1	5	105
3	1 2	CLASS II.—DOMESTIC. Engaged in supplying Board and Lodging ,, Domestic Service and Attendance	15 23	13 13	1 7	6		1			2 3	37 59
		Total—Class II	38	26	8	12	6	1			5	96
4 5 6	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	CLASS III.—COMMERCIAL.  Dealing in Property and Finance  "Art and Mechanic Productions "Textile Fabrics, Dress and Fibrous Materials	1 2	6 4		2	••	··· <sub>1</sub>			1	9 9
7	1	" Food, Drinks, Narcotics, and	••		1	••	• •	• •	• •	••	••	5
8		Stimulants	23	59	2	4	• •	• •	• •	••	2	90
9 10 11		Substances, N.E.I	11 3  17	10 4 3 46		4 1 					1 1 	$\begin{array}{c} 26 \\ 9 \\ 3 \\ 74 \end{array}$
$^{12}_{13}$		Speculators on Chance Events		2		•••						2
		Total—Class III.	57	138		15	••			3	5	227
14	1 2 3 4 & 5	CLASS IV.—TRANSPORT AND COMMUNICATION. Engaged in Railway Traffic ,, Traffic on Roads ,, ,, Seas and Rivers ,, Postal, Telegraph & Telephone	7 24 25	2 18 4	 1 34	2 4 25			1 	1	1 2 3	13 50 99
	6	Service	10 1	4		1						15 1
		Total—Class IV.				•••	6	··· 1	··· 1	2	6	
		CLASS V.—INDUSTRIAL.	67	28	35	32						178
15 16		Working in Art and Mechanic Productions  "Textile Fabrics, Dress, and Fibrous Materials"	15	63	4	8	• •	2	2	••	2	96
17		,, Food, Drinks, Narcotics, and	3	17	3		• •	٠٠.	• •	••	••	26
18		Stimulants	17		1	3	••	1	• •	1	2	55 27
$\begin{array}{c} 19 \\ 20 \end{array}$		" Metals and Other Minerals " Fuel, Light and other forms of	32 11	16			1	.1	••		2	37 36
21		Energy Engaged in Construction of Buildings,	3	5	••	1	••	••	••	••	••	9
22		Roads, Railways, etc ,, Disposal of Dead or of Refuse	$\begin{array}{c} 46 \\ 2 \end{array}$	$\frac{30}{1}$		3	• •	• •		•••		83 3
23		" Undefined Industrial Pursuits	385	46	2	9	•••	••	•••		4	446
		TOTAL—CLASS V	514	212	13	29	1	4	2	2	14	791

# Commonwealth Census.—Half-caste Males of Non-European Race, classified according to Occupation, Commonwealth, 1911.—continued.

-		OCCUPATION.				]	Race	• •				9
Order	Sub- order	Designation.	Australian Aboriginals.	Chinese.	Hindus.	Negroes.	Polynesians	Japanese.	Syrians.	Malays.	Others.	Total Non-
24	$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	CLASS VI.—PRIMARY PRODUCERS. Engaged in Agricultural Pursuits	523 1,392		9 11	19 15	12 4	2 2		3 4	7 11	73] 1,536
	4 5 6	,, Capture, etc., or Wild Animals and their Produce ,, Fisheries ,, Forestry ,, Water Conservation & Supply	149 106 105		 1 3	 3 1 1	 5 		••	  	 2 2	154 117 125 15
	7	" Mining and Quarrying  Total—Class VI	$\frac{49}{2,335}$		27	45	$-\frac{1}{22}$	$-\frac{2}{6}$		<u>1</u>	24	188 2,866
25	:	CLASS VII.—INDEPENDENT	14	•••	•••	•••	•••	••		• •	1	18
	:	TotalBreadwinners	3,081	834	90	140	35	16	5	17	60	4,278
26 27	1	CLASS VIII.—DEPENDENTS.  Dependent on Natural Guardians Supported by Voluntary or State Contribu-	2,144		149	51	64	35	35	21		3,254
	2	tions Criminal Class (under Legal Detention)	57 1	1		:			••		1	58 2
		TOTAL—CLASS VIII	2,202	684	149	51	64	35	35	21	73	3,314
		GRAND TOTAL	5,283	1518	239	191	99	51	40	38	133	7,592

- (ii.) Half-caste Australian Aboriginals. Of the total of 5283 male half-caste aboriginals, 3081, or about 58 per cent., were breadwinners. Of these, 1392 were employed in pastoral pursuits, mainly as station hands, and 523 in agricultural pursuits, mainly as farm hands, while 385 were classed as industrial workers imperfectly defined, and consisted mainly of general labourers. The other occupations which were at all extensively represented were the capture of wild animals and produce 149, fisheries 106, and forestry 105.
- (iii.) Chinese. Of 1518 male half-caste Chinese, 834, or 55 per cent., were breadwinners. The principal occupations followed were industrial pursuits 212, agricultural pursuits 156, commercial pursuits 138, mining 124, and pastoral pursuits 97.
- (iv.) Other Races. The Australian aboriginals and the Chinese accounted for 6801 of a total of 7592 males half-castes of non-European race, representing nearly 90 per cent. of the total. The other races comprised 791 males, of whom 363, or about 46 per cent., were breadwinners. The occupations most largely represented were shipping and agricultural and pastoral pursuits.
- 14. Occupation.—Female Half-castes.—Corresponding particulars for female half-castes for the Commonwealth as a whole are furnished in the succeeding table.

Commonwealth Census, 1911.—Half-caste Females of Non-European Race, classified according to Occupation, Commonwealth, 1911.

		Occupation.					R	ACE.				fon- Races.
Order	Sub- order	Designation.	Australian Aboriginals	Chinese.	Hindus.	Negroes.	Polyn'sians	Japanese.	Syrians.	Malays.	Others.	Total Non- European Rac
$_2^1$	•	CLASS I.—PROFESSIONAL. Engaged in Government, Defence, Law, etc. Ministering to Religion, Charity, Health, Education, etc						••				
		Total—Class I	13	11		5					2	33
3	1 2	CLASS II.—DOMESTIC. Engaged in supplying Board and Lodging , Domestic Service and Attendance	44 823	27 123		5 19	12	4	2		2 10	79 1,008
		TOTAL—CLASS II	867	150	11	24	12	4	2	5	12	1,087

Commonwealth Census, 1911.—Half-caste Females of Non-European Race, classified according to Occupation.—continued.

		Occupation.					RAC	ь.				1. BC68
Order	Sub- order	Designation.	Australian Aboriginals.	Chinese.	Hindus.	Negroes.	Polynesians	Japanese.	Syrians.	Malays.	Others.	Total Non- European Races
		CLASS III.—COMMERCIAL.								and the second		
4			1		•• :	• • •		••	••	• •	••	]
5 6		,, Art and Mechanic Production Textile Fabrics, Dress and Fi		• • •	•••	••	• •		• • •	•••	•••	• •
0		rous Materials		1								
7		,, Food, Drinks, Narcotics, a		10					1	-		1.
8		Stimulants	$\frac{1}{2}$	13	•••	• • •	••	•••	••	••	••	1.
Ū		Substances, N.E.I										
9		" Fuel and Light	• • • • •	• •	••	• • •	• •	•••	• •			• •
10 11		,, Metals and Other Minerals General and Undefined Merchants & Deal		16	• •						::	i
12		Speculators on Chance Events				• •			• •	• •	•••	
13		Engaged in Storage	• • • • • • • • • • • • • • • • • • • •	• •	• •	•••	• •	••	••	•••	•••	••
		TotalClass III	3	30		•••	• • •		1			3
		CLASS IV.—TRANSPORT AND COMMUNICATION	) T									
4	1	Engaged in Railway Traffic	1									
	2	" Traffic on Roads		• •	!	• •	• •	• •		•••		• •
	$\frac{3}{4 \& 5}$	Dertal Talamanh & Talamba		• •	••	••	••	•••	•••	•••	• •	••
	* 0. 0	Service										
	6	Messengers, etc						••	••	• •	••	
		TOTAL—CLASS IV	1				٠.			••	••	
_		CLASS V.—INDUSTRIAL.									1	1
5 6		Working in Art and Mechanic Production Textile Fabrics, Dress, and Fi		5	••	. 1	•••	• •	• •	• •	1	1
· [		rous Materials	4	73	2	13		1	1		5	9
7	·	" Food, Drinks, Narcotics, a	nd			1						14
8		Stimulants Animal and Vegetable Su		8	1	1	••	• •	••	• •	••	1
0		stances, N.E.I.										
9					• •		• •	• •	••		• •	• •
0		Fuel, Light and other forms Energy	01							!		
1		Engaged in Construction of Buildings,									i	
		Roads, Railways, etc.			• •		• •	• •	• •	• •	• •	• •
2		" Disposal of Dead or of Refuse " Undefined Industrial Pursuit		1		1	• •			• •	• •	2
_		"	ļ								6	12
		TOTAL—CLASS V	12	87	3	16		1	1			12
4	1	CLASS VI.—PRIMARY PRODUCERS.	8							1	1	1
=	2	Engaged in Agricultural Pursuits	32			• •	• • •			1		3
	3	" Capture, etc., of Wild Anima	als			į						
	4	and their Produce Fisheries	6	1 3		••						
	5	,, Forestry				•						٠.
	6	" Water Conservation & Supply		1 :			• •	••	••	•••	••	
	7	" Mining and Quarrying	1	· ·	•••		•••	•••	••		··-	
		TOTAL—CLASS VI	49	··-				•••		1	1	5
5		CLASS VII.—INDEPENDENT	4	• • •	•••	1	••		•••		••	
		Total—Breadwinners	949	278	16	46	12	5	4	6	21	1,33
6		CLASS VIII.—DEPENDENTS. Dependent on Natural Guardians	3,816	1218	143	99	63	<b>3</b> 1	40	39	103	5,55
7	1	Supported by Voluntary or State Contril	ou-		_						,	-
	2	tions	64	i	1	• •				1	1	7
	-	Total—Class VIII	3,881	ļ	144	99			40	40		5,62
			0,001			55	1					
		GRAND TOTAL		1501	700	145	75	36	44	40	10-	6,96

Of the total of 6962 female half-castes, 1337, or about 19 per cent., were breadwinners. The largest number of breadwinners, 949, occurred in the case of the aboriginals, and the heaviest proportion, 32 per cent., in the case of the negroes. The principal occupations for all races were those of house servants, a small proportion of the Chinese and negroes being engaged in dressmaking and of the aboriginals in pastoral pursuits.

15. **Metropolitan.**—The number of Non-Europeans of the full-blood resident in the several metropolitan areas of the Commonwealth at the date of the Census is furnished in the following table, particulars being given for the principal races and for each sex:—

Non-Engonean	Moteonolitan	Donulation	1911 [Full-blood].	

		No	n-Eu	ropean	Metropolita	n Popul	ation, 19	l1 [Full-b	lood].		
Metroj includ	polita ing su	n Area, ıburbs.	1	Chinese	Japan- ese.	Hindus.	Syrians.	Poly- nesians.	Malays.	Others.	Total, No European Races.
				1		MALES.					
Nd	-			0.106		105	160	86		100	2 705
Sydney Melbourne	• •	• •	• •	3,183		125 60	163 163	80	$\frac{1}{2}$	166 46	$\begin{array}{c c} 3,787 \\ 2,681 \end{array}$
Brisbane	• •	• •	• •	2,388		28	26	26		38	567
delaide	• •	• •	• •			28 25		i -	• • •	9	285
erth	• •	• •	• •	170 766			79	1		73	925
Hobart	• •	• •		78		34	10 3				826
				-							
TOTAL	• •	• •	• •	7,006	145	273	444	113	14	332	8,32
						FEMAL	ES.				
ydney	٠.			151	6	22	115	11		45	350
<b>l</b> elbo <b>ur</b> ne				128	6	9	149	. 1		15	30
Brisbane				38		1	40	. 1		13	9
delaide				10			60	i		4	74
erth				19		2	3			4	3
Iobart				]	1		2				
Total				347	22	34	369	13		81	86
				-		!					
						PERSO	<u>No.</u>		i		
ydney	• •		• •	3,334		147	278	97	1	211	4,13
lelbo <b>urn</b> e		• •		2,516		69	312	1	2	61	2,98
risbane		• •	٠.	459		29	66	27		51	66
delaide				180		25	139			13	35
erth		• •		785		36	13	1	11	77	96
lobart	• •	• •	• •	79	• • • • • • • • • • • • • • • • • • • •	1	5	• •	••	• •	8
TOTAL			• •	7,353	167	307	813	126	14	413	9,19
			E I.		of Total fo	MALES					
dno				<b>%</b>	% 52.94	.%.17	% 04.00	% 50	% 3.57	$\begin{array}{c} \%\\ 43.23\end{array}$	% 36.04
ydney Ielbourne	• •	• •	• •	40.09		11.17	24.92	32.58			
risbane	• •	• •	• •	53.17	56.41	8.33	66.80	.00	40.00	46.46	47.8
	• •	• •	٠.	7.28		7.87	16.67	1.85	.00	3.76	5.4
delaide	• •	• •	• •	70.54		5.73	44.38	.00	.00	10.34	29.7
erth	• •	• •	٠.	43.15		6.19	58.82	5.88	1.63	8.76	16.9
lobart	• •	• •	• •	19.50		6.67	6.38	.00	• •	.00	17.3
LL METRO	POLIT	AN ARI	EAS	32.06	4.42	8.53	34.23	6.63	1.36	12.97	23.8
				-		FEMALI	ES.				
ydney				53.17	85.71	34.92	21.30	47.83	.00	54.88	35.00
elbourne				59.26		100.00	75.63	33.33		93.75	68.6
risbane				17.92		5.88	24.54	.30	.00	16.25	10.2
delaide				71.43		.00	63.83	.00		66.67	61.6
erth				51.35		33.33	42.86		.00	40.00	20.6
[ob <b>ar</b> t	• •	• •	• •	3.70	• •	••	4.88	••	••		4.4
LL METRO	POLIT	an Ari	EAS	38.68	10.58	34.69	35.41	3.57	.00	39.71	30.3
****				!		PERSO	NS.	· · · · · · · · · · · · · · · · · · ·			I
ydney				40.54	54.76	12.44	23.28	33.80	3.45	45.28	35.9
lelbourne				53.45	59.57	9.47	70.75	20.00	40.00	53.04	49.4
risbane			• • •	7.66	1.89	7.77	20.69	1.55	.00	4.67	5.82
				70.59	15.38	5.69	51.10	.00	.00	13.98	33.27
dealide		-							1.63	9.13	17.02
				43.32	2.31	0.49	54.17	41.00			
dealide erth Iobart	::	• •	• •	43.32 18.50	2.31	$\substack{6.49 \\ 6.67}$	$54.17 \\ 5.68$	$\begin{array}{c} 5.88 \\ .00 \end{array}$		.00	15.7

Chinese, Japanese, Hindus and Polynesians were more numerous in Sydney than in any other metropolitan area, while Syrians were most numerous in Melbourne, and Malays in Perth.

Of the races specified, the Syrians and Chinese were proportionately the most largely represented in the metropolitan areas of the Commonwealth,  $34\frac{3}{4}$  per cent. of the Syrians, and  $32\frac{1}{3}$  per cent. of the Chinese being so resident. On the other hand, little more than  $1\frac{1}{4}$  per cent.

of the Malays, or  $4\frac{3}{4}$  per cent. of the Japanese in Australia, were resident in metropolitan areas. For all races specified except Polynesians and Malays, there was a larger proportion of females resident in metropolitan areas than was the case with the males of the same race.

For persons of the half-blood, the figures for the principal races for the several metropolitan areas are as follows:—

Follows:—

Falf-caste Metropolitan Population, 1911

Metropoli including			Aust. Abgnls.	Chinese	Hindus	Negroes	Poly- nesians	Japan- ese.	Syrians	Malays	Others	Total Half- caste
	_			<del>-</del>		MALES	•			,	•	
Sydney			73	209	19	62	5	10	4	2	13	397
Melbourne			7	127	19	13		9	11		3	189
Brisbane			15	40	$\overline{12}$	2	2	6	1		2	80
Adelaide			10	26	4	8		i			$\overline{2}$	51
Perth			12	18	$ar{f 4}$	7	1	3			4	49
Hobart	• •	•••		4	$\overline{4}$	i						9
TOTAL			117	424	62	93	8	29	16	2	24	775
			j		E	EMALE	ss.		. I		I	
Sydney			75	232	21	51	2	8	4	1	12	406
Melbourne	• • •	• • •	14	122	13	17	-	5	5	i l	3	180
Brisbane		• • •	63	55	11	6		8	_	_	6	154
Adelaide	• •		12	35	1	7	-	_	9	••	i	65
Perth	• •	• •	34	17	4	í	• •	1	2	••	5	64
Hobart		• •	2	8	_			_	_	••	-	11
HODAIU	••	• •			•••	•••		•••	•••	•••	••	
TOTAL	••	••	200	469	50	82	8	22	20	2	27	880
					I	PERSON	s.	·				-
Sydney			148	441	40	113	7	18	8	3	25	803
Melbourne			21	249	32	30		14	16	1	6	369
Brisbane			78	95	23	8	7	14	1		8	234
Adelaide			22	61	5	15		1	9		3	116
Perth			46	35	8	8	1	4	2		9	113
Hobart			2	12	4	ĺ	1			••	••	20
TOTAL			317	893	112	175	16	51	36	4	51	1,655

	MALES.												
Sydney Melbourne Brisbane Adelaide Perth Hobart	•••		% 3.13 2.95 1.10 2.89 1.58	37.25 27.31 11.27 52.00 54.55 8.00	% 26.39 26.03 28.57 20.00 23.53 28.57	% 65.26 48.15 4.76 66.67 58.33 33.33	21.74 2.78 .00 33.33	% 52.63 69.23 50.00 50.00	20.00 100.00 16.67 .00 .00	22.22 .00 .00 .00 .00	30.23 25.00 4.88 20.00 44.44 .00	% 12.50 22.42 4.10 11.46 5.83 4.62	
All Metropoli	itan A	reas	2.21	27.93	25.94	48.69	8.08	56.86	40.00	5.26	18.05	10.21	
	÷				F	EMALE	S.	_	1				
Sydney Melbourne Brisbane Adelaide Perth Hobart	itan Ar	· · · · · · · · · · · · · · · · · · ·	3.45 $6.67$ $5.49$ $3.47$ $4.76$ $1.92$ $4.14$	40.63 28.44 15.11 64.81 62.96 15.38	32.81 40.63 42.31 6.67 22.22 .00	71.83 47.22 26.09 77.78 33.33 .00	9.09 .00 10.20 .00  100.00	61.54 71.43 80.00  20.00 .00	16.00 100.00 .00 .90 100.00 .00	50.00 12.50 .00  .00 	52.17 27.27 11.32 7.69 41.67 	13.68 24.36 9.02 14.51 8.17 6.59	
						PERSO	NS.	· <u>·                                    </u>					
Sydney Melbourne Brisbane Adelaide Perth Hobart		• • • • • • • • • • • • • • • • • • • •	3.28 4.70 3.11 3.18 3.12 .88	38.96 27.85 13.21 58.65 58.33 11.76	29.41 30.48 33.82 14.29 22.86 21.05	68.07 47.62 12.31 71.43 53.33 16.67	15.56 .00 5.79 .00 33.33 100.00	56.25 70.00 63.64 50.00 40.00	17.78 100.00 14.29 75.00 66.67	27.27 7.69 .00 .00 .00	37.88 26.09 8.51 13.04 42.86	13.07 23.32 6.39 12.99 6.96 5.52	
All Metropoli	itan Ar	eas	3.13	29.58	28.07	52.08	9.20	58.62	42.86	4.76	19.77	11.37	

With two exceptions all the races specified were more numerously represented in Sydney than in any other Capital. The exceptions were (a) Syrians, who were most numerous in Melbourne; and (b) Polynesians, who were as numerous in Brisbane as in Sydney.

Amongst the Half-castes, Japanese and Negroes were proportionately most largely represented in Metropoltian areas, and Australian Aboriginals and Malays proportionately least largely represented.

# CHAPTER XVIII.

### CONJUGAL CONDITION.

1. Nature and Scope of Inquiry.—The expression "Conjugal Condition," or "Condition as to Marriage," is frequently used on the census schedule as a main head of inquiry, but is open to possible objection on the score of not being readily understood by some of the persons responsible for supplying the desired information. On the present occasion no such general head was employed, but item 4 of the personal card comprised the following fourfold direction: "If married, write M. If widowed, write W. If divorced, write D. If never married, write N.M." Possibly, as a result to some extent of this direct and explicit request, the returns in respect of conjugal condition were more complete than for any other inquiry, and this head was the only one under which there appeared a smaller number of unspecified on the present occasion than appeared in the census of 1901. For the purpose of making as full use as possible of the information supplied on the personal cards for deciding whether persons whose conjugal condition was unspecified were or were not married, a code of rules was drawn up for the census tabulators, of which the following were the principal:

(i.) All males under the age of 14 and females under the age of 12 must be classed as never

married, whatever the statement given on the card.

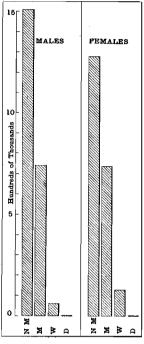
- (ii.) Where no reply is furnished and the card relates to a male under the age of 21, or to one who, whatever his age, stands in the relation of son, stepson, grandson, or nephew to the head of the household, insert N.M.
- (iii.) Where no reply is furnished and the card relates to a female under the age of 15, or to one who, whatever her age, stands in the relation of daughter, step-daughter, grand-daughter, or niece to the head of the household, insert N.M.
  - (iv.) In other cases where no reply is furnished, insert N.S. (not stated).
- 2. Tabulation.—Particulars for each conjugal condition were tabulated for each sex according to age, the age classification being as follows:—(i.) A single group under 14; (ii.) single ages from 14 to 20 inclusive; (iii.) a group of four years, 21-24; (iv.) quinquennial groups from 25 onwards. The information was tabulated in full detail in respect of counties, and corresponding subdivisions of the several States, as a necessary preliminary to the computation of data for the whole of the States, but it was considered that the heavy expense of publishing such county details would not be warranted. The results have accordingly been filed in the Census Bureau, particulars in full detail being published only for the Commonwealth as a whole, for States and Territories, and for Metropolitan areas. The total number of males and females of each conjugal condition, irrespective of age, has, in addition, been published for each county, etc., and appears on pp. 1090 to 1095 of the Detailed Tables.
- 3. Summary of Results.—In a summarised form under some of the principal age-groups the data in respect of conjugal condition are as follows:-

Conjugal Condition of Population of the Commonwealth, 1911.

Conj	TUGAL		•	AGE	LAST BIRTHD	AY.		All
Cont	OITION	•	Under 15.	15-44.	45–59.	6064.	65 and over.	Ages.
				MA	LES.			
Never Marr Married Widowed Divorced	ried  	••	714,573 3 	700,328 417,844 11,015 1,134	65,755 228,619 20,053 949	9,818 35,021 6,786 134	18,224 56,621 26,007 151	1,508,698 738,108 63,861 2,368
TOTAL		••	714,576	1,130,321	315,376	51,759	101,003	2,313,035
				FEM	ALES.			
Never Marr Married Widowed Divorced	ried  	•••	695,907 19	542,742 495,471 19,513 1,383	30,391 181,389 39,461 627	3,582 25,031 15,590 59	5,211 31,997 53,526 71	1,277,833 733,907 128,090 2,140
TOTAL	••		695,926	1,059,109	251,868	44,262	90,805	2,141,970
		!		PEF	RSONS.	-		
Never Marr Married Widowed Divorced	ied  		1,410,480 22	1,243,070 913,315 30,528 2,517	96,146 410,008 59,514 1,576	13,400 60,052 22,376 193	23,435 88,618 79,533 222	2,786,531 1,472,015 191,951 4,508
TOTAL			1,410,502	2,189,430	567,244	96,021	191,808	4,455,005

In this and the succeeding tables the figures shewn are those which have been obtained by a proportionate distribution of the numbers unspecified, whether as to age or conjugal con-

Conjugal Condition of the Commonwealth Population, 1911.



GRAPH No. 76.

dition. In all the age-groups specified in the above table, bachelors exceeded spinsters, but widows exceeded widowers. Married women exceeded married men, and divorced women exceeded divorced men in the age-groups below 45, but the contrary was the case in the groups above that age.

For some purposes a statement shewing the numbers in each conjugal condition aged 15 and upwards is more convenient than the totals at all ages including children. Such a statement is furnished in the succeeding table:—

Commonwealth Population Aged 15 and Upwards, 1911.

Conjugal Condition.	Males.	Females.	Persons.
Never Married	794,125	581,926	1,376,051
Married	738,105	733,888	1,471,993
Widowed	63,861	128,090	191,951
Divorced	2,368	2,140	4,508
Total	1,598,459	1,446,044	3,044,503

For all conjugal conditions except "widowed," the males aged 15 and upwards exceeded the females. In the case of widowed persons, however, the females were more than twice as numerous as the males.

The accompanying Graph (No. 76) furnishes a representation of the total number of persons of each sex in each conjugal condition at the Census of 3rd April, 1911. In this graph, N.M. denotes persons who had never been married; M denotes persons who were married at the date of the Census; W denotes widowers and widows; and D denotes divorced persons. The scale for females is the same as that for males.

In the following table are given, for each Conjugal Condition, the proportions per 10,000 in each age-group:—

Proportion per 10,000 in each Age-group, Commonwealth, 1911.

Conjugal		•	Age	LAST BIRTHD.	AY.		ALL
CONDITION.		Under 15.	15–44.	45-59.	60-64.	65 and over.	Ages.
			MAI	LES.			
Never Married Married Widowed Divorced	• • • • • • • • • • • • • • • • • • •	10,000  	6,196 3,697 97 10	2,085 7,249 636 30	1,897 6,766 1,311 26	1,804 5,606 2,575 15	6,523 3,191 276 10
TOTAL	••	10,000	10,000	10,000	10,000	10,000	10,000
			FEM	ALES.			
Never Married Married Widowed Divorced	••	10,000  	5,125 4,678 184 13	1,206 7,202 1,567 25	810 5,655 3,522 13	574 3,524 5,894 8	5,966 3,426 598 10
TOTAL		10,000	10,000	10,000	10,000	10,000	10,000
			PEI	RSONS.		. 11	
Never Married Married Widowed Divorced		10,000	5,678 4,172 139 11	1,695 7,228 1,049 28	1,396 6,254 2,330 20	1,222 4,620 4,146 12	6,255 3,304 431 10
TOTAL		10,000	10,000	10,000	10,000	10,000	10,000

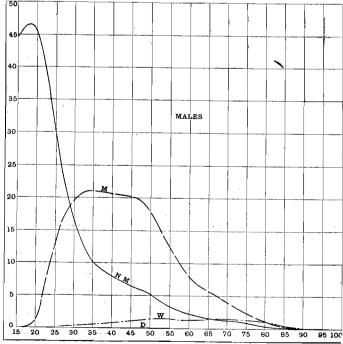
<sup>4.</sup> Detailed Results for the Commonwealth.—The following table furnishes full details in respect of Commonwealth males and females after proportionate distribution of those unspecified as to age or conjugal condition.

hae and	Conjugal	Condition	۸ŧ	Commonwealth	Donulation	1011
WRO WHIT	COTTREST	COHMINION	υL	Соштопменти	ropulation,	TOTT.

AGE LASS	r		MA	LES.				FEM	IALES.		
BIRTHDAY		Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL.	Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL.
Under 14		671,283				671,283	653,725	1			653,726
14		43,290	3			43,293	42,182	18			42,200
15		43,977	8		\	43,985	43,624	93	1		43,718
16		44,868	25			44,893	43,727	347	2		44,076
17		45,995	72	1		46,068	43,943	1,067	3		45,013
18		47,366	230	2		47,598	43,182	2,571	9	1	45,763
19	• • '	45,224	558	1	2	45,785		4,397	12		44,568
20		45,673		11		47,151		7,259	55		45,781
21-24		156,030		238		182,551	115,095	58,113	442		173,714
25-29		120,063		1,087		201,263	78,390		1,694		189,669
30-34		67,911		2,069		172,276	44,730		3,223		160,878
35–39		46,030		3,131	321	152,903	30,075	104,392	5,626	374	140,467
40-44		37,191		4,475		145,848	21,357	95,293	8,446	366	125,462
45–49		29,831	97,685	6,053	407	133,976	14,928	82,151	11,844	319	109,242
50-54		22,121	79,155	7,245	338	108,859	9,964	61,388	13,755	229	85,336
5559		13,803	51,779	6,755	204	72,541	5,499	37,850	13,862	79	57,290
60-64		9,818	35,021	6,786		51,759	3,582	25,031	15,590		44,262
65–69		7,182	25,830	7,403		40,491	2,535	16,742	17,385	38	36,700
70-74		5,684	16,499	7,029	43	29,255	1,422	9,287	15,453		26,176
75-79		3,350	9,494	6,095		18,951	751	4,253	11,589		16,609
80-84		1,397		3,739		8,863	349	1,336	6,053	2	7,740
85-89		466		1,311		2,651	122	304	2,293	1	2,720
90-94		108		354		641	21	68	615		704
9599		29	27	59	1	116	9	4	114		127
100 and	over	8	10	17	•••	35	2	3	24		29
TOTAL	: .	1,508,698	738,108	63,861	2,368	2,313,035	1,277,833	733,907	128,090	2,140	2,141,970

In the case of males, bachelors predominated in all age-groups below 30; married men in all groups between 30 and 80, and widowers in all groups above 80. In the case of females, spinsters predominated in all age-groups below 25, married women in all groups between 25 and 65, and widows in all groups above 65. Comparing males and females, it will be seen that in all age-groups bachelors exceeded spinsters, while widows exceeded widowers. In the case of married persons, females exceeded males in all age-groups below 40, while males were in excess in all groups above

Commonwealth Males, Conjugal Condition and Age, 1911.



GRAPH No. 77.

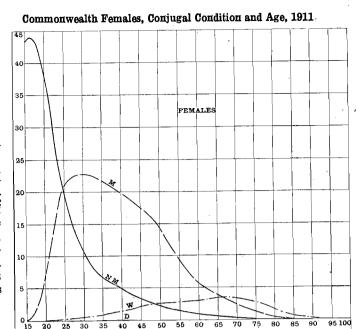
that age. In the case of divorced persons, with the exception of an unimportant deviation at age 19, females exceeded males in all age-groups under 45, while males were in excess in all groups above that age.

For all ages combined from 14 upwards, bachelors exceeded spinsters by 213,307; married men exceeded married women by 4202; and divorced men exceeded divorced women by 228. On the other hand widows exceeded widowers by 64,229. For all conjugal conditions males aged 14 and upwards exceeded females by 153,508.

In the accompanying graph (No. 77) there is furnished a representation of the number of males of each age from 15 upwards, who were of each conjugal condition at the Commonwealth Census of 1911. In this graph N.M. denotes "never married," M denotes married, W denotes

widowed, and D denotes divorced. The number of divorced males was so small relatively that the curve representing them does not shew in the reproduction here given. The base of each small rectangle represents five years of age, and the height represents 5000 persons.

Graph No. 78 furnishes for females a representation females similar to that furnished for males by Graph No. 77 above. The scale employed is identical with that used in the case of males, and the interpretation of the symbols used is also the same. It will be seen, by comparison of Graph 78 with Graph No. 77, that the trend of the several female curves agrees fairly closely with that of the corresponding male curves. In the case of married persons the male curve rises less steeply than the female, and is flatter in the neighbourhood of the maximum point. The maximum for females is at or or about age 30, and for males at or about age 33.



GRAPH No. 78.

The succeeding table furnishes the proportion per 10,000 of those in each age-group who belonged to each of the four conjugal conditions:—

Proportionate Distribution, according to Conjugal Condition, of Males and Females in each Age-group. Commonwealth, 1911.

AGE LAST			Males.			FEMALES.				
BIRTHDAY.	Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL.	Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL
Under 14	10,000				10,000	10,000				10,000
14	9,999	1			10,000	9,996	4			10,000
15	9,998	2			10,000	9,979	21		•	10,000
16	9,994	6		1	10,000	9,921	78	1		10,000
17	9,984	16			10,000	9,762	237	1		10,000
18	9,951	48	1		10,000	9,436	562	2		10,000
19	9,878	121		1	10,000	9,011	986	3		10,000
20	9,687	311	2		10,000	8,401	1,586	12	1	10,000
21-24	8,547	1,438	13	2	10,000	6,626	3,345	25	4	10,000
25-29	5,965	3,974	54	7	10,000	4,133	5,765	89	13	10,000
30-34	3,942	5,921	120	17	10,000	2,780	6,999	200	21	10,000
35-39	3,010	6,764	205	21	10,000	2,141	7,432	401	26	10,000
40-44	2,550	7,118	307	25	10,000	1,702	7,596	673	29	10,000
45-49	2,227	7,291	452	30	10,000	1,367	7,520	1,084	29	10,000
50-54	2,032	7,271	666	31	10,000	1,167	7,194	1,612	27	10,000
55-59	1,903	7,138	931	28	10,000	960	6,607	2,419	14	10,000
60-64	1,897	6,766	1,311	26	10,000	810	5,655	3,522	13	10,000
65-69	1,774	6,379	1,828	19	10,000	691	4,562	4,737	10	10,000
70-74	1,943	5,640	2,403	14	10,000	543	3,548	5,904	5	10,000
75–79	1,768	5,010	3,216	6	10,000	452	2,561	6,977	10	10,000
80-84	1,576	4,189	4,219	16	10,000	451	1,726	7,820	3	10,000
85-89	1,758	3,289	4,945	8	10,000	448	1,118	8,430	4	10,000
90-94	1,685	2,746	5,522	47	10,000	298	966	8,736		10,000
95-99	2,500	2,328	5,086	86	10,000	709	315	8,976		10,000
100 and over	2,286	2,857	4,857		10,000	690	1,034	8,276	••	10,000
ALL AGES	6,523	3,191	276	10	10,000	5,966	3,426	598	10	10,000

The maximum proportion of married males for any age-group was 72.91 per cent. for the group 45-49, while the corresponding maximum for females was 75.96 per cent. for the age-group 40-44.

5. Comparisons with Previous Censuses.—(i.) General.—Statistics of the number of persons of each conjugal condition are available in age-groups for each census from 1881 onwards. The age-grouping, however, has differed considerably in the several States, and in all cases there are fairly large numbers whose age or conjugal condition, or both, were unspecified. The variations in age-grouping consisted mainly in the use of decennial groups in some States where quinquennial groups were used in others, or the use of a quinquennial group in some where single ages were used in others. In these cases a distribution of the larger groups was effected on the basis of the results furnished in those cases where the smaller groups were used, and results

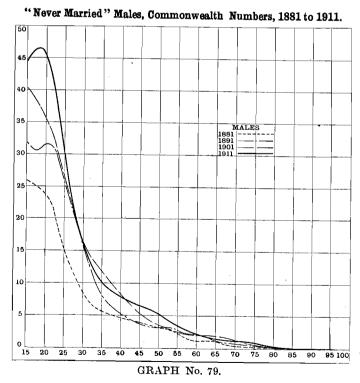
for the Commonwealth as a whole were thus obtained for the age-group under 15, for single ages 15 to 20 inclusive, for the group 21-24, for quinquennial groups from 25-9 to 80-84 inclusive, and for the final group 85 and over. The numbers unspecified, whether as to age or conjugal condition, were proportionately distributed on the basis of the specified.

(ii.) "Never Married" Males.—The number and proportion of "never married" males in the Commonwealth at each census from 1881 is furnished in the following table:—

AGE LAST		Num	BER.		Proportion per 10,000 of Total Male Population of the Same Age.				
BIRTHDAY.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	
Under 15 15 16 17 18 19 20 21-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84	442,651 24,840 24,455 24,062 23,663 23,042 23,694 78,615 56,453 32,175 24,410 21,808 17,123 14,290 7,517 6,493 3,076 1,936 967 516	593,290 31,685 31,277 29,403 30,415 31,053 32,488 119,917 106,449 57,618 32,178 22,289 16,562 15,898 10,970 9,217 4,612 3,345 1,473 615	670,269 40,310 39,921 37,729 36,469 35,880 34,696 124,024 106,054 69,330 49,065 33,978 21,155 15,346 10,089 9,979 8,059 5,070 2,264	714,573 43,977 44,868 45,995 47,366 45,224 45,673 156,030 120,063 67,911 46,030 37,191 29,831 22,121 13,803 9,818 7,182 5,684 3,350	10,000 10,000 10,000 9,997 9,992 9,891 9,694 8,435 5,873 4,113 3,260 3,063 2,694 2,593 2,242 2,334 1,978 1,909	10,000 9,997 9,996 9,988 9,976 9,934 9,799 8,690 6,108 4,015 3,069 2,776 2,361 2,505 2,134 2,163 1,900 1,989 1,768	10,000 10,000 9,998 9,993 9,979 9,935 9,785 8,857 6,493 4,412 3,210 2,682 2,374 2,271 1,907 2,157 2,082 1,949 1,787	10,000 9,998 9,994 9,984 9,981 9,878 9,687 8,547 5,965 3,942 3,010 2,550 2,227 2,032 1,903 1,897 1,774 1,943 1,768	
85 and over	130	301	1,077 334	1,397 611	2,039 1,736	$^{1,640}_{1,811}$	1,776 1,513	1,576 $1,775$	
ALL AGES	851,916	1,181,055	1,351,098	1,508,698	7,012	6,931	6,831	6,523	

Ages of "Never Married" Males.—Commonwealth, 1881 to 1911.

Although fluctuations are in evidence, the general tendency indicated by the above table is that of an increase in the number of "never married" males in any age-group at the

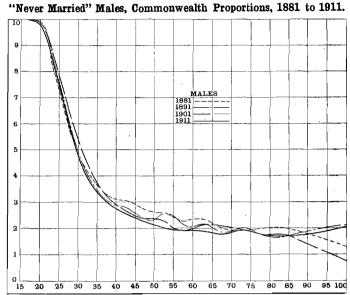


successive censuses, but a decrease in the proportion of total males in such age-group represented thereby. At all ages below 30, the "never married" males represented considerably more than 50 per cent. of the total males of such ages, while at all ages above 30 they represented considerably less than 50 per cent. For ages above 60 the proportion of "never married" males varied but slightly, and in 1911 was approximately 18 per cent. at all such ages.

Commonwealth "never married" males from age 15 upwards are represented in the attached graph (No. 79) as at each of the Censuses 1881, 1891, 1901 and 1911. In this graph the base of each small rectangle represents 5 years of age, and the height represents 5000 persons. It will be noted that the curves for the last three Censuses coincide at about age 28, and again at about age 62.

Corresponding to Graph No. 79, which represents the numbers of unmarried males at each age, Graph No. 80, furnishes a representation of the proportion of the total Commonwealth males

of each age who had never been married at each of the last four censuses. The general indication furnished by the graph is that The general indication there is no very marked change in the proportion at any age from one census to another, but that there is a general tendency, from age 40 onwards, for the proportion never married to diminish with successive censuses. At ages under 40 the tendency is less regular, and although at practically all such ages the proportion in 1911 was less than the corresponding proportions in 1891 and 1901, the proportions in 1881 were in several instances less than those for any of the other three censuses. This was especially so between ages 21 and 30. In this graph the base of each small rectangle represents 5 years of age, and the height of each represents 10 per cent. of the male population at the age in question.



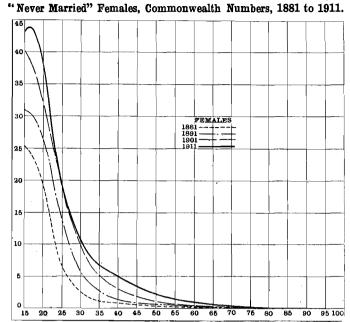
GRAPH No. 80.

(iii.) "Never Married" Females.—The succeeding table shews the number and proportion of "never married" females in the Commonwealth at each census from 1881 onwards:—

Ages of "Never Married" Females.—Commonwealth, 1881 to 1911.

AGE LAST		Num	BER.		Proportion per 10,000 of Total Female Population of the Same Age.				
BIRTHDAY.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	
Under 15	433,883	579,252	655,914	695,907	10,000	10,000	10,000	10,000	
15	25,015	30,820	38,962	43,624	9,981	9,990	9,996	9,979	
16	24,463	30,647	39,230	43,727	9,934	9,933	9,961	9,921	
17	23,521	29,486	37,153	43,943	9,740	9,781	9,858	9,762	
18	22,198	29,034	35,346	43,182	9,377	9,404	9,554	9,436	
19	20,248	27,267	32,584	40,159	8,745	8,849	9,121	9,011	
20	17,942	25,834	30,906	38,460	7,821	8,141	8,501	8,401	
21-24	46,995	77,026	96,576	115,095	5,559	6,106	6,866	6,626	
25-29	20,194	45,529	67,906	78,390	2,729	3,282	4,324	4,133	
30-34	8,207	18,752	33,829	44,730	1,368	1,778	2,480	2,780	
3 <b>5–</b> 39	4,882	8,930	19,745	30,075	871	1,193	1,635	2,141	
4044	3,294	5,334	11,736	21,357	658	887	1,230	1,702	
<b>45–4</b> 9	1,847	3,421	6,444	14,928	440	649	978	1,367	
50-54	1,309	2,608	4,143	9,964	406	562	786	1,167	
5 <b>5</b> –59	827	1,449	2,611	5,499	402	403	605	960	
60-64	754	1,173	1,945	3,582	440	425	523	810	
<b>65–69</b>	326	660	1,301	2,535	336	400	427	691	
70-74	234	476	746	1,422	370	410	404	543	
<b>75–79</b>	109	255	403	751	354	443	415	452	
80-84	45	126	213	349	295	476	422	451	
85 and over	32	52	83	154	595	416	407	430	
ALL AGES	656,325	918,131	1,117,776	1,277,833	6,340	6,244	6,224	5,966	

It will be seen that in the case of females there is a well-marked, though not uniform, tendency for both the number and the proportion of "never married" females in each age-group to increase with the successive censuses, and that for ages from 30 to 65 the proportion "never married" was more than twice as great in 1911 as in 1881. In all age-groups below 25 the "never married" females represented considerably more than 50 per cent. of the total females of such ages, while in all age-groups above 25 they represented considerably less than 50 per cent. For the year 1911 the proportion of "never married" decreased with age throughout life in the case of females, and did not, as in the case of males, attain an approximately stationary position beyond age 60.



In the accompanying Graph (No. 81) a representation is furnished of the numbers of females at each age who at the Australian Censuses of 1881, 1891, 1901 and 1911 were classed as "never married." The base of each small rectangle represents 5 years of age, and the height represents 5000 persons. There is in evidence at successive Censuses a natural tendency for the number of "never married" females at any age to increase.

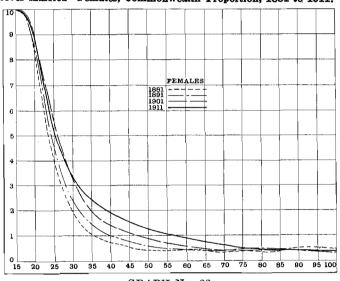
Graph No. 82 furnishes a representation of the proportion of the Australian female population at each age that belonged to the class of "never married" at each of the last four Censuses. In this graph the base of each small rectangle represents 5 years of age, and the

GRAPH No. 81.

"Never Married" Females, Commonwealth Proportion, 1881 to 1911.

height of each represents 10 per cent. of the female population at the age in question. For ages 15 to 28 the proportion "never married" was greater in 1901 than 1911, but with this exception each successive Census shewed for ages up to 75 a higher proportion "never married" than was shewn for the same age by the preceding Census.

(iv.) Married Males.—In the following table are given particulars concerning the number and proportion of married males in the Commonwealth in successive age-groups at the censuses from 1881 onwards:—



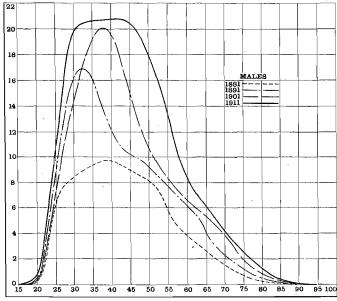
GRAPH No. 82,

Ages of Married Males.—Commonwealth, 1881 to 1911.

AGE LAST		Num	BER.		Proportion Pop		000 of Tot the Same A	
BIRTHDAY.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.
Under 15 16 18 19 20 21-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84	20 254 736 14,385 39,019 44,892 48,584 46,776 43,028 36,529 22,462 17,202 9,326 5,470 2,198	1 11 13 32 68 201 661 17,858 66,470 83,453 69,693 54,425 49,149 42,180 34,651 26,902 14,830 8,947 3,906 1,498	2  9 25 77 229 747 15,814 56,293 85,515 99,863 87,615 62,835 46,495 37,077 29,378 23,150 13,951 6,184 2,444	3 8 25 72 230 558 1,467 26,256 79,976 102,010 103,421 103,821 97,685 79,155 51,779 35,021 25,830 16,499 9,494 3,713	3 8 109 301 1,543 4,059 5,739 6,489 6,570 6,670 6,630 6,701 6,184 5,996 5,393 4,513 3,698	3 4 11 22 64 199 1,294 3,814 5,815 6,647 6,778 7,008 6,645 6,740 6,313 6,111 5,320 4,688 3,995	2 7 21 64 211 1,129 3,447 5,442 6,532 6,916 7,052 6,882 7,007 6,351 5,982 5,363 4,882 4,031	2 6 16 48 121 311 1,438 3,974 5,921 6,764 7,118 7,291 7,271 7,138 6,766 6,379 5,640 5,010 4,189
85 and over	306	490	650	1,085	4,085	2,948	2,945	3,151
ALL AGES	332,130	475,439	568,353	738,108	2,734	2,790	2,874	3,191

With a few exceptions of minor importance the proportion of married males was higher at all ages in 1911 than at either of three preceding censuses. The maximum number married was reached in 1881 and 1901 in the age-group 35-39, in 1891 in the group 30-34, and in 1911 in the group 40-44. On the other hand, the maximum proportion married was reached at all the censuses in the group 45-49, amounting in 1911 to almost 73 per cent. in that group. Married males under 21 years of age totalled 1017, or 3.06 per 1000 married males, in 1881; 987, or 2.08 per 1000, in 1891; 1089, or 1.92 per 1000, in 1901; and 2363, or 3.20 per 1000, in 1911. The

Married Males, Commonwealth Numbers, 1881 to 1911.



GRAPH No. 83.

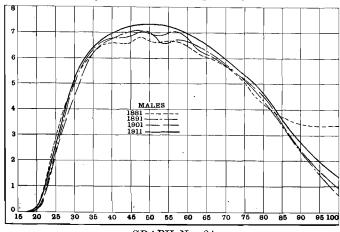
decline and subsequent rise in the proportion of husbands who were minors is probably due to the fact that the economic outlook in 1891 and 1901 was less bright than was the case in 1881 and 1911. In 1911 married males represented approximately 32 per cent. of the male population of all ages as compared with little more than 27½ per cent. in 1881.

In the accompanying Graph (No. 83) a representation is given of the number of married males at each age at each of the last four Censuses. The base of each small rectangle represents 5 years of age, and the height represents 2000 persons. Between the ages of 15 and 32 the numbers of married males in 1891 exceeded the corresponding numbers in 1901. With this exception the

numbers at any age at each successive Census was greater than the corresponding number at the previous Census.

Graph No. 84 furnishes for each of the last four Censuses a representation of the proportions of the Australian male population at each age that were married at the dates of the several Censuses. The base of each small rectangle represents 5 years of age, and the height represents 10 per cent. of the Australian male population for the age in question. The general indication furnished by this graph is that with some

Married Males, Commonwealth Proportions, 1881 to 1911.



GRAPH No. 84.

this graph is that with some exceptions the proportion of married men has increased from Census to Census at all the more important ages. The most important of these exceptions occurs in the case of the 1901 Census, where between the ages of 21 and 35 the proportion was lower than for any other of the Censuses. From ages 28 to 85 the proportions for 1911 were higher at all ages than at any other of the Censuses. The upward movement of the 1881 curve after age 85 is based on a very small body of facts, and not being confirmed by the experience of the succeeding Censuses, must be regarded as accidental.

(v.) Married Females.—Particulars relative to the number and proportion of married females in the Commonwealth in each age-group at the censuses from 1881 onwards are given in the table on the next page.

This table presents some peculiar features, the most striking of which is that, although with the unimportant exceptions of ages 15 and 16 the proportion of married women in each age-group was lower in 1911 than in 1881, the proportion when the whole female population is taken into account is considerably higher for 1911 than for 1881. Similar observations apply to a comparison of the results for 1891 and 1901 with those for 1881, and also to the comparison of the 1891 and 1911 results. The apparent anomaly is in part due to the difference of the age distribution of married females at the several censuses, but to a greater degree to the fact that

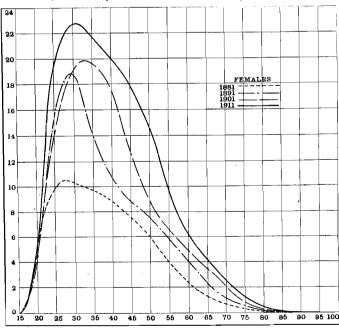
the proportion of females of marriageable age in the population has increased rapidly with successive censuses. Thus in 1881 nearly 42 per cent. of the female population were under the age of 15, as compared with  $39\frac{1}{4}$  per cent. in 1891,  $36\frac{1}{2}$  per cent. in 1901, and only  $32\frac{1}{2}$  per cent. in 1911. The maximum number of married females was attained in 1881 and 1891 in the age-group 25-29, and in 1901 and 1911 in the group 30-34. The maximum proportion was attained in 1881 and 1891 in the age-group 35-39, and in 1901 and 1911 in the group 40-44. The maxima so attained were approximately  $84\frac{1}{2}$  per cent. in 1881,  $81\frac{3}{4}$  per cent. in 1891, 79 per cent. in 1901, and 76 per cent. in 1911. Married females under the age of 21 totalled 10,134, or 30.83 per 1000 married females in 1881; 12,094, or 25.56 per 1000 in 1891; 10,875, or 19.09 per 1000 in 1901; and 15,753, or 21.47 per 1000 in 1911.

Ages of Married	FemalesCommonwealth,	1881 to	1911.
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l			Nимвев.		Proportion per 10,000 of Total Female Population of the Same Age.				
AGE LAST BIRTHDAY.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	Census of 1881.	Census of 1891.	Census of 1901.	Census of . 1911.	
Under 15	19	5	2	19					
15	47	28	16	93	19	9	4	21	
16	158	205	153	347	64	66	39	78 237	
17	617	654	537	1,067	256	217	142	562	
18	1,461	1,834	1,642	2,571	617	594	444	986	
19	2,893	3,523	3,120	4,397	1,249	1,143	873	1.586	
20	4,939	5,845	5,405	7,259	2,153	1,842	1,487	3,345	
21-24	36,891	48,479	43,577	58,113	4,363	3,843	3,098		
25-29	52,221	90,727	86,928	109,346	7,057	6,540	5,536	5,765 6,999	
30–34	49,267	82,857	98,391	112,593	8,210	7,857	7,214	7,432	
35-39	47,341	61,228	94,202	104,392	8,446	8,178	7,802		
40-44	41,240	48,563	75,311	95,293	8,236	8,072	7,895	7,596	
45-49	33,980	41,089	50,405	82,151	8,094	7,789	7,650	7,520	
50-54	24,512	33,308	37,517	61,388	7,603	7,183	7,121	7,194	
<b>55–59</b>	14,114	24,041	27,933	37,850	6,868	6,682	6,476	6,607	
60-64	10,188	16,206	20,562	25,031	5,939	5,870	5,533	5,655	
65-69	4,903	7,986	13,860	16,742	5,057	4,845	4,546	4,562	
70-74	2,592	4,366	6,616	9,287	4,099	3,757	3,586	3,548	
75-79	931	1,629	2,529	4,253	3,023	2,831	2,605	2,561	
80-84	312	516	852	1,336	2,043	1,951	1,688	1,726	
85 and over	89	183	198	379	1,654	1,464	972	1,059	
ALL AGES	328,715	473,272	569,756	733,907	3,175	3,219	3,173	3,426	

A comparison of the two preceding tables indicates that at three out of the four censuses the number of married males in the Commonwealth has exceeded the number of married females, while at one, that of 1901, the females were in excess, but that in all cases the excess has been proportionately small. Thus in 1881 married males exceeded married females by 3415; in 1891

Married Females, Commonwealth Numbers, 1881 to 1911.



GRAPH No. 85.

by 2167; and in 1911 by 4201; while in 1901 married females exceeded married males by 1403.

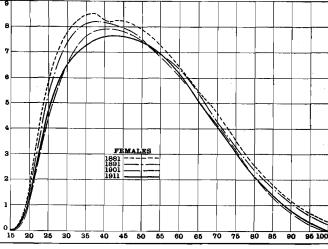
The excess of married males is due in large measure to the effects of immigration, and to the inclusion in the census results of shipping population, while the excess of married females noted in 1901 was probably due to the fact that at the date of the census a considerable number of Australian troops was in South Africa.

The accompanying Graph (No. 85) furnishes a representation for each of the last four Censuses of the number of married females at each age. The base of each small rectangle represents 5 years of age, and the height of each represents 2000 persons. In general the number at any age for one Census exceeds the corresponding numbers of previous Censuses, the principal exception being the excess of the 1891 over those for 1901 at ages prior to 29.

In Graph No. 86 is given a representation of the proportions of the Australian females of each age who were married at each of the last four Censuses. The base of each small rectangle represents 5 years of age, and the height represents 10 per cent. of the Australian female population for the age in question. In general it may be said that the graph indicates a decreasing proportion of married women at any age at successive Censuses.

(vi.) Widowers.—The number and proportion of widowers in the Commonwealth in each age-group at the censuses from 1881 onwards are shewn in the following table:—

Married Females, Commonwealth Proportions, 1881 to 1911.



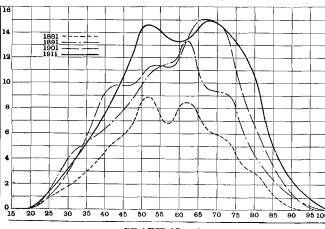
GRAPH No. 86.

Ages of Widowers.-Commonwealth, 1881 to 1911.

		]	Number.		Proportion per 10,000 of Total Male Population of the Same Age.				
AGE LAST BIRTHDAY.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	
17		2	1	1		1			
18		6	1	2		2		1	
19	1	5	5	1	<b>}</b>	2	1	• • •	
20	12	5	16	11	5	2	4	2	
21-24	200	215	172	238	22	15	12	13	
25–29	658	1,335	902	1,087	68	76	55	54	
30–34	1,161	2,388	2,117	2,069	148	166	135	120	
35–39	1,881	2,908	3,687	3,131	251	277	241	205	
40–44	2,615	3,546	4,855	4,475	367	441	383	307	
45-49	3,403	4,392	4,967	6,053	536	626	557	452	
50-54	4,282	5,372	5,591	7,245	777	846	828	666	
55-59	3,543	5,760	5,671	6,755	1,057	1,120	1,072	931	
60-64	4,121	6,478	6,845	6,786	1,482	1,520	1,480	1,311	
65-69	3,151	4,821	7,459	7,403	2,026	1,987	1,927	1,828	
70-74	2,736	4,520	6,980	7,029	2,698	2,688	2,683	2,403	
75–79	1,706	2,952	4,213	6,095	3,502	3,543	3,326	3,216	
80-84	1,079	1,637	2,539	3,739	4,263	4,365	4,188	4,219	
85 and over	313	871	1,222	1,741	4,179	5,241	5,537	5,057	
ALL AGES	30,862	47,213	57,243	63,861	254	277	289	276	

The accompanying graph furnishes a representation of the number of widowers in the Australian population at each age at each of the last four Censuses. The base of each small rect-

Widowers, Commonwealth Numbers, 1881 to 1911.



GRAPH No. 87.

angle represents 5 years of age, and the height represents 100 persons.

With the exception of minor fluctuations the number of widowers in each age-group has increased with succeeding Censuses, but the proportion has, in general, shewn a tendency to decline. Here again, as in the case referred to on p. 249, in relation to married females, there is shewn a decrease in proportion at practically all ages in 1911 as compared with 1881, combined with an increase in the proportion of total widowers to total population. The cause of this is a marked change in the relative age distribution of widowers, combined with a marked diminution in the proportion of males at the younger

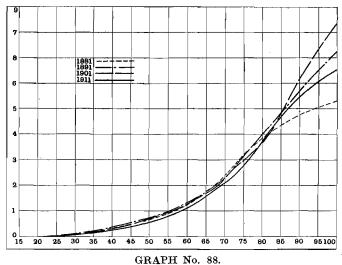
ages, there being about  $36\frac{1}{4}$  per cent. of the total male population at ages under 15 in 1881, as compared with  $30\frac{1}{4}$  per cent. in 1911. The proportion of widowers in the population increases with age, and at the last three censuses reached 50 per cent. in the final group of 85 and upwards. There were 13 widowers under the age of 21 in 1881; 18 in 1891; 23 in 1901; and 15 in 1911. The maximum number of widowers in any age-group

was reached in 1881 in the group 50-54; in 1891 in the group 60-64; and in 1901 and 1911 in the group 65-69.

In Graph No. 88 a representation is furnished of the proportions of the Australian male population who were widowers at each of the last four Censuses. The base of each small rectangle represents 5 years of age, and the height represents 10 per cent. of the Australian male population for the age in question.

(vii.) Widows.—The number and proportion of widows in the Commonwealth in each age-group at the Censuses from 1881 onwards are shewn in the next table:—

Widowers, Commonwealth Proportions, 1881 to 1911.

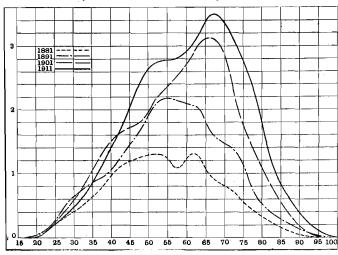


Ages of Widows.—Commonwealth, 1881 to 1911.

	,	Num	SER.		Proportion per 10,000 of Total Female Population of the Same Age.				
AGE LAST BIRTHDAY.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	
15	• •	4		1		1		••-	
16	4	3		2	2	1	• •	1	
17	. 10	6		3 9	4	2			
18	13.	6	7	12	6	2 7	2	2 3	
19	14	21	19	55	26	16	5 11	12	
$egin{array}{ccc} 20 & \dots \ 21 ext{-}24 & \dots \end{array}$	59 659	50 625	40 461	442	78	50	33	25	
95 90	1,588	2.414	2,028	1,694	214	174	129	89	
	2,536	3,800	3,930	3,223	422	360	288	200	
30–34 35–39	3,830	4,671	6,510	5,626	683	624	539	401	
40-44	5,538	6,236	8,166	8,446	1,106	1,037	856	673	
45-49	6,154	8,220	8,932	11,844	1,466	1,558	1,356	1,084	
50-54	6,418	10,448	10,974	13,755	1,991	2,253	2,083	1,612	
55-59	5,611	10,486	12,564	13,862	2,730	2,914	2,913	2,419	
60-64	6,211	10,229	14,648	15,590	3,621	3,705	3,941	3,522	
65-69	4,466	7,838	15,314	17,385	4,607	4,755	5,024	4,737	
70-74	3,497	6,777	11,083	15,453	5,531	5,832	6,007	5,904	
75-79	2,040	3,870	6,778	11,589	6,623	6,726	6,980	6,977	
80-84	1,170	2,003	3,981	6,053	7,662	7,573	7,888	7,820	
85 and over	417	1,015	1,757	3,046	7,751	8,120	8,621	8,508	
ALL AGES	50,235	78,722	107,192	128,090	485	535	597	598	

The accompanying Graph (No. 89) furnishes a representation of the number of widows of each age who were included in the Australian population at the Censuses of 1881, 1891, 1901 and 1911. The base of each

Widows, Commonwealth Numbers, 1881 to 1911.



GRAPH No. 89.

1901 and 1911. The base of each small rectangle represents 5 years of age, while the vertical height represents 200 persons.

The number of widows in each age-group under 40 was, with unimportant exceptions, less in 1911 than 1901. In each age-group under 35 it was less in 1911 than in 1891, and in each age-group under 25 it was less in 1911 than in 1881. In all age-groups above 40 the number of widows was considerably higher in 1911 than at previous Censuses. On the other hand the proportion at practically all ages was lower in 1911 than in 1901, and for age-groups under 65 was also lower than for 1881 and 1891. Notwithstanding this, the

proportion of widows in the total female population was practically identical in 1901 and 1911, and considerably higher in 1911 than in 1881 and 1891. The explanation of this apparent

anomaly is similar to that already given on pp. 249 and 251 in connexion with married women and widowers. The maximum number of widows was reached in agegroup 50-54 in 1881; in group 55-59 in 1891; and in group 65-69 in 1901 and 1911. proportion of widows increases continuously with age, and in 1911 was 85 per cent. for the group of females aged 85 and over. There were, at the Census of 1881, 100 widows under the age of 21; 90 in 1891; 66 in 1901, and 82 in 1911.

In Graph No. 90 a representation is furnished for each of the last four Censuses of the proportion of the Australian female population at each age who were widows. The base of each small rectangle represents 5 years of

age, and the height represents 10 per cent. of the Australian female population for the age in question.

(viii.) Divorced Males.—Age particulars in respect of divorced males in the Commonwealth recorded at the censuses 1881 to 1911 are given in the following table:—

Proportion per 10,000 of Total Male Population of the Same Age. NUMBER. AGE LAST BIRTHDAY. Census of 1881. Census of Census of Census of Census of Census of Census of Census of 1901. 1891. 1911. 1881. 1911. 1891. 1901. 1 2 .. 21 20  $\frac{1}{9}$ 2 7 17 27 2 21-24 . . . . 25-29 77 5 137  $\frac{2}{4}$ ıĭ 60 68 30~34 2 167 286 321 21 25 30 31 28 26 262 3 35 - 39 $\frac{19}{17}$ 41 233 361 5 5 4 40-44 34 27 28 407 338 45-49 15419 50-54 131  $\frac{14}{12}$ 204 55-59  $\frac{6}{4}$ 55 33 134 76 43 60-64 16 9 19 65-69 5 5 1 14 70-74 14 3 1 5 5  $\frac{12}{14}$ 6 75-79 7 3 80 - 84. . 5 17 85 and over... 6 <sup>2</sup> 10 1,2342 2,368 22 51 3322 ALL AGES

Ages of Divorced Males.—Commonwealth, 1881 to 1911.

The number and proportion of divorced men in each age-group have increased at successive censuses, owing partly to increasing accuracy in the returns and partly to increased facilities for divorce and increased advantage taken of such facilities. At the census of 1881, Tasmania was the only State which furnished particulars concerning divorce. At the censuses of 1891 and 1901 all the States except South Australia furnished such particulars, while in 1911 the information was obtained for the whole Commonwealth. According to the 1911 figures, divorced men represented 1 per thousand of the male population. The maximum number of divorced men in any age-group in 1911 was that for the group 45-49, while the maximum proportion was that for the group 50-54. One divorced male under 21 years of age was recorded in 1891, and two in 1911.

<sup>&</sup>lt;sup>1</sup> Tasmania only. <sup>2</sup> Exclusive of South Australia.

(ix.) Divorced Females.—Tabulated according to age, the particulars for divorced females recorded in the Commonwealth at the censuses of 1881 to 1911 are as follows:—

Ages	of Divorced	Females.—Commonwealth.	1881 to	1911.
------	-------------	------------------------	---------	-------

		Numi	BER.		Proportion per 10,000 of Total Female Population of the Same Age.				
AGE LAST BIRTHDAY.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	Census of 1881.	Census of 1891.	Census of 1901.	Census of 1911.	
18				1					
19		2	2			1	1		
20	1	2	5	7		1	1	1	
21-24		14	51	64		1	3	4	
25-29		60	168	239		4	11	13	
30-34		49	244	332		5	18	21	
35-39	1	40	287	374		5	24	26	
40-44	2	26	178	366		4	19	29	
45-49	1	19	107	319		4	16	29	
50-54	2	10	52	229		2	10	27	
55-59		4	28	79		1	6	14	
60-64		1	11	. 59			3	13	
65-69			10	38			3	10	
70~74		1	5	14		1	3	5	
75-79	• •			16				10	
80-84	• •		1	2			2	3	
85 and over	••	• • •	•••	1	• •	••	••	3	
ALL AGES	61	2282	1,1492	2,140	• •	2 2	6 <sup>2</sup>	10	

<sup>&</sup>lt;sup>1</sup> Tasmania only. <sup>2</sup> Exclusive of South Australia.

In the case of divorced females as in that of divorced males the figures for succeeding censuses have become increasingly complete, the omissions to record being the same in the two cases. Curiously, the proportions of total population represented by divorced females recorded at the four censuses was practically identical with the corresponding proportions in the case of males, these proportions being less than a half per 10,000 in 1881; 2 per 10,000 in 1891; 6 per 10,000 in 1901; and 10 per 10,000 in 1911.

The maximum number of divorced females in any age-group was, in 1911, reached in the age-group 35-39, and the maximum proportion in the groups 40-44 and 45-49. Four divorced females under the age of 21 were recorded in 1891; 7 in 1901; and 8 in 1911.

(x.) Combined Comparative Results for Males.—In the succeeding table the number of males of each conjugal condition is shewn for the more important age-groups for each of the censuses 1881 to 1911:—

Conjugal Condition and Age, Males.—Commonwealth, 1881 to 1911.

	~				Number	WHOSE AGI	E LAST BIE	THDAY WAS	_	ALL
	CEN	isus.		Under 15.	15–44.	45–59.	60-64.	65 & over.	15 & over.	AGES.
					NEVE	R MARRII	ED.			_
1881		• •		442,651	357,217	38,930	6,493	6,625	409,265	851,916
1891				593,290	524,772	43,430	9,217	10,346	587,765	1,181,055
1901				670,269	607,456	46,590	9,979	16,804	680,829	1,351,098
1911	• •	• •	٠.	714,573	700,328	65,755	9,818	18,224	794,125	1,508,698
				:	MA	RRIED.			·	
1881					194,673	102,019	17,202	18,236	332,130	332,130
1891	•		• •	· · · <sub>1</sub>	292,885	125.980	26,902	29,671	475,438	475,439
1901			• •	$\begin{vmatrix} & & 1 \\ 2 & \end{vmatrix}$	346,187	146,407	29,378	46,379	568,351	568,353
1911	•••	••	••	3	417,844	228,619	35,021	56,621	738,105	738,108
					WI	DOWED.				
1881					6,528	11,228	4,121	8,985	30,862	30,862
1891	• • •	• • •	• • •	::	10,410	15,524	6,478	14,801	47,213	47,213
1901	• • •	• • •		.,	11,756	16,229	6,845	22,413	57,243	57,243
1911	•••		• •		11,015	20,053	6,786	26,007	63,861	63,861
				1	D	IVORCED.				
1001									5	51
1881 1891	• •		• •	•••	5		16	"11	332	3322
	• •	• •	• •		216	89	55	58	1,234	1,234
1901	• •	• •	• •	•••	760	361		151		2,368
1911	• •	• •	• •	• •	1,134	949	134	101	2,368	△,308

<sup>&</sup>lt;sup>1</sup> Tasmania only. <sup>2</sup> Exclusive of South Australia.

Conjugal Condition and Age, Males.—Commonwealth, 1881 to 1911.—continued.

_	,			Number w	nose Age L	AST BIRTH	DAY WAS-		ALL
CENS	σs.		Under 15.	15.44,	45-59.	60-64.	65 & over.	15 & over.	1
		-		ALL CON	JUGAL CO	NDITION	S.		
			442,651	558,423	152,177	27,816	33,846	772,262	1,214,913
			593,291	828,283	185,023	42,613	54,829	1,110,748	1,704,039
			670,271	966,159	209,587	46,257	85,654	1,307,657	1,977,928
			714,576	1,130,321	315,376	51,759	101,003	1,598,459	2,313,035
				Under 15.  442,651 593,291 670,271	CENSUS.  Under 15.   15-44.  ALL CON	CENSUS.  Under 15.   15-44.   45-59.  ALL CONJUGAL CO	CENSUS.  Under 15.   15-44.   45-59.   60-64.  ALL CONJUGAL CONDITION	Under 15.   15-44.   45-59.   60-64.   65 & over.	CENSUS.         Under 15.         15-44.         45-59.         60-64.         65 & over.         15 & over.           ALL CONJUGAL CONDITIONS.

With two exceptions the number in each age-group and for each conjugal condition increased with successive censuses, the exceptions being "never married" males in the age-group 60-64, where the number in 1911 was less than the number in 1901, and widowed males for the same age-group and censuses. As noted in subsections (viii.) and (ix.) of this section, the figures for divorced persons for censuses prior to 1911 are defective.

The corresponding proportions of total males for each age-group and conjugal condition

are as follows:-

Proportionate Age and Conjugal Distribution of Males.—Commonwealth, 1881 to 1911.

				I	PROPORTION WHER	n' per 10,00 e Age Last	0 Males i Birthda	N AGE-GROUY WAS-	TP	$\mathbf{ALL}$
	CENS	sus.		Under 15.	15–44.	45–59.	60–64.	65 & over.	15 & over.	Ages.
					NEVE	R MARRII	ED.			4
1881 1891 1901 1911	• • • • • • • • • • • • • • • • • • • •	• •		10,000 10,000 10,000 10,000	6,397 6,336 6,287 6,196	2,558 2,347 2,223 2,085	2,334 2,163 2,157 1,897	1,957 1,887 1,962 1,804	5,299 5,292 5,206 4,968	7,012 6,931 6,831 6,523
					м	ARRIED.				
1881 1891 1901 1911	•••	•••			3,486 3,536 3,583 3,697	6,704 6,809 6,986 7,249	6,184 6,313 6,351 6,766	5,388 5,412 5,414 5,606	4,301 4,280 4,346 4,618	2,734 2,790 2,874 3,191
					wı	DOWED.				
1881 1891 1901 1911	••		  		117 126 122 97	738 839 774 636	1,482 1,520 1,480 1,311	2,655 2,699 2,617 2,575	400 425 438 399	254 <b>2</b> 77 289 276
					DI	VORCED.				
1881 1891 1901 1911	••	••	•••		 2 8 10	 5 17 30	$egin{array}{c} \cdot \cdot \cdot \\ 4 \\ 12 \\ 26 \end{array}$	 2 7 15	 3 10 15	 2 6 10

The general result indicated by this table is a well-defined decrease in all the age-groups in the proportion of males who were "never married" at the successive censuses, and also a decrease, though less well-defined in the case of widowers. On the other hand there is a welldefined increase in all age-groups in the proportion of married men at successive censuses. Between the censuses of 1881 and 1911 the proportion of the male population aged 15 and upwards who were "never married" decreased from 53 per cent. to about  $49\frac{3}{4}$  per cent., while the proportion who were married increased from 43 per cent. to about 46½ per cent., the proportion of widowers being approximately 4 per cent. at the two censuses.

(xi.) Combined Comparative Results for Females.—The following table furnishes particulars concerning the number of females of each conjugal condition for the more important age-groups for each of the censuses 1881 to 1911.

Conjugal Condition and Age, Females.—Commonwealth, 1881 to 1911.

	~				Number	whose Age	LAST BIR	THDAY WAS-	_	ALL
	CEN	sus.		Under 15.	15-44.	45-59.	60-64.	65 & over.	15 & over.	Aces.
					NEVE	R MARRII	ED.			
1881				433,883	216,959	3,983	754	746	222,442	656,325
1891		• •		579,252	328,659	7,478	1,173	1,569	338,879	918,131
1901				655,914	443,973	13,198	1,945	2,746	461,862	1,117,776
1911	••	• •	• •	695,907	542,742	30,391	3,582	5,211	581,926	1,277,833

Conjugal Condition and Age, Females.—Commonwealth, 1881 to 1911.—continued.

	Ω··	~~~			NUMBER V	HOSE AGE	Last Birt	HDAY WAS-	•	ALL
	CEN	sus.		Under 15.	15-44.	45-59.	60-64.	65 & over.	15 & over.	AGES.
					MA	RRIED.				
1881				19	237,075	72,606	10,188	8,827	328,696	328,715
1891				5	343,943	98,438	16,206	14,680	473,267	473,272
1901				2	409,282	115,855	20,562	24,055	569,754	569,756
1911	• •	• •	• •	19	495,471	181,389	25,031	31,997	733,888	733,907
					WI	DOWED.			<u> </u>	
1881					14,251	18,183	6,211	11,590	50,235	50,235
1891	• •	• •	• •	• • •	17,836	29,154	10,229	21,503	78,722	78,722
1901	• •	• •	• •	• •	21,161	32,470	14,648	38,913	107.192	107.192
1911		• •		••	19,513	39,461	15,590	53,526	128,090	128,090
				<u> </u>	Di	VORCED.				
1881			-						0	61
1891	• •	• •	• •		3	33	٠٠ ,	1	6 228	228
1901	• •	• •	• •		193 935	187	$\frac{1}{11}$	16	1,149	1,149
1901	• •	• •	• •	• •		627	59	71		
1911	••	••	• •		1,383	627	99	/1	2,140	2,140
				A	LL CONJU	JGAL CON	DITIONS.			
1881				433,902	468,288	94,775	17,153	21,163	601,379	1,035,281
1891	• • •			579,257	690,631	135,103	27,609	37,753	891,096	1,470,353
1901				655,916	875,351	161,710	37,166	65,730	1.139,957	1,795,873
1911		• • •		695,926	1,059,109	251,868	44,262	90,805	1,446,044	2,141,970
	• •	• •	- •	300,020	_,,,,,,,,,	201,000		00,000	_,,	

<sup>&</sup>lt;sup>1</sup> Tasmania only.

With the exception of married females under 15, and of widows in the age-group 15-44 for the Census of 1911, the number in each age-group and for each conjugal condition increased with successive Censuses. As noted in subsections (viii.) and (ix.) above, the figures for divorced persons for censuses prior to 1911 are defective.

From the standpoint of reproductive efficiency, one of the most important groups in this table is that of married females in the group 15-44. It will be seen that the number in this group increased from 227 075 in 1821 to 405 471 in 1911

group increased from 237,075 in 1881 to 495,471 in 1911.

The corresponding proportions of total females for each age-group and conjugal condition are as follows :-

Proportionate Age and Conjugal Distribution of Females.—Commonwealth, 1881 to 1911.

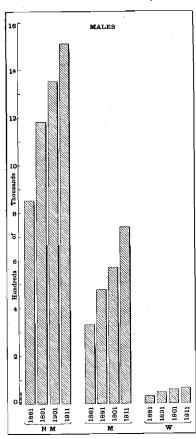
				PR		PER 10,000 AGE LAST		IN AGE-GROV	U <b>P</b>	ALL
	Cen	sus.		Under 15.	15-44.	45-59.	60-64.	65 & over.	15 & over.	Ages.
					NEVE	R MARRI	ED.			
1881 1891 1901 1911	••	•••	••	10,000 10,000 10,000 10,000	4,633 4,759 5,072 5,125	420 554 816 1,206	440 425 523 810	353 416 418 574	3,699 3,803 4,052 4,024	6,340 6,244 6,224 5,966
				(	М	ARRIED.				_
1881 1891 1901 1911	•••	•••			5,063 4,980 4,676 4,678	7,661 7,286 7,164 7,202	5,939 5,870 5,533 5,655	4,171 3,888 3,660 3,524	5,466 5,311 4,998 5,075	3,175 3,219 3,173 3,426
					wi	DOWED.				
1881 1891 1901 1911			••		304 258 242 184	1,919 2,158 2,008 1,567	3,621 3,705 3,941 3,522	5,476 5,696 5,920 5,894	835 883 940 886	485 535 597 598
		-	•		D	IVORCED.				
1881 1891 1901 1911				  	 3 10 13	 2 12 25	  3 13	  2 8	 3 10 15	 2 6 10

<sup>&</sup>lt;sup>2</sup> Exclusive of South Australia.

In the case of "never married" females above the age of 15, there is a well-defined increase in all the age-groups at successive censuses, the proportion for the important group of 15-44 having risen from about 46 $\frac{1}{4}$  per cent. to 51 $\frac{1}{4}$  per cent. On the other hand, in the case of married females, there is, with minor fluctuations, a decrease in the proportion in each group, the proportion for 15-44 falling from about  $50\frac{3}{4}$  to  $46\frac{3}{4}$ . In the case of widows the proportions for 1891 and 1901 were in most cases higher than for 1881 or 1911, while the proportions for 1911 were, in the main, lower than those for 1881.

Of the female population aged 15 and upwards, the proportion "never married" increased from 37 per cent. to  $40\frac{1}{4}$  per cent.; the proportion married decreased from  $54\frac{2}{3}$  per cent. to  $50\frac{3}{4}$  per cent., while the proportion who were widows increased from  $8\frac{1}{3}$  per cent. to rather more than  $8\frac{3}{4}$  per cent.

#### "Never Married," Married, and Widowed Persons, Commonwealth, 1881 to 1911.



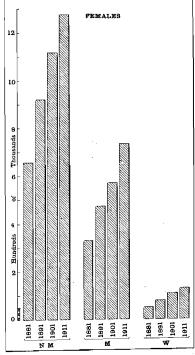
GRAPH NO. 91.

In the accompanying Graphs (Nos. 91 and 92) is furnished a comparative view of the numbers of males and females separately who were "never married," married, or widowed at each of the last four Censuses. The scale is the same for both graphs, and represents the number of persons

of each sex and conjugal condition at each Census.

In both sexes there have been considerable increases from Census to Census in the numbers concerned. In the "never case of the married" males and widowed males, this increment was most extensive between the Censuses of 1881 and 1891, and least extensive between 1901 and 1911. On the other hand amongst married males the largest increase in number took place between 1901 and 1911, and the smallest between 1891 and 1901.

In the case of "never married" females, again the largest increment was between

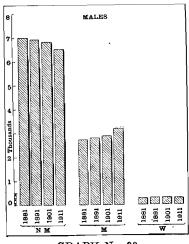


GRAPH No. 92.

1881 and 1891, and the smallest between 1901 and 1911, but widows, while shewing the largest increase between 1881 and 1891, shewed the smallest increase between 1891 and 1901.

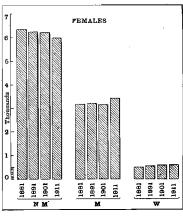
The number of married women differed throughout but slightly from the number of married men, increasing most largely between 1901 and 1911, and least extensively between 1891 and 1901.

Proportions "Never Married," Married, and Widowed, Commonwealth, 1881 to 1911.



GRAPH No. 93.

Graphs Nos. 93 and 94 furnish a representation for each of the last four Censuses of the proportion of the Australian males and females respectively who were "never married," married, widowed at the dates specified. The scale is the same for both graphs, and represents in each instance the number per 10,000 for the sex and Census in question.



GRAPH No. 94.

6. Metropolitan and Extra-Metropolitan Statistics.—The tables contained in this section present a view of the conjugal data according to age, classified under the heads of metropolitan and extra-metropolitan, the former term comprising the six capital cities and their suburbs, and the latter the remainder of the Commonwealth. The following table relates to the numbers within the metropolitan areas mentioned:—

Age and Conjugal Condition of the Metropolitan Population of the Commonwealth, 1911.

AGE LAST	,			MALES.				$\mathbf{F}_{\mathbf{E}}$	MALES.		
BIRTHDAY		Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL.	Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL.
Under 15		244,333	2			244,335	241,362	6		ļ	241,368
15 - 19		81,784	430	1	1	82,216	87,991	2,964	11	1	90,967
20-24		70,454	12,289	102	13	82,858	72,239	25,444	217	43	97,943
25 - 29		39,203	32,984	433	80	72,700		44,309	779	158	84,793
30 - 34		21,025	39,553	792	140	61,510	23,209	45,494	1,558	228	70,489
35 - 39		13,357	38,410	1,184	155	53,106		42,404	2,865		61,258
40 - 44		10,237	39,253	1,632		51,300	11,329	40,235	4,486		56,300
45-49		7,668	38,368	2,289		48,512	7,998	35,790	6,319		50,329
50 - 54		5,464	31,491	2,671	163	39,789	5,487	26,484	7,205		39,323
<b>55–59</b>		3,165	20,410	2,517	100	26,192		16,193	7,102	55	26,476
60-64		2,132	13,356	2,468	62	18,018	2,140	10,630	7,908	40	20,718
65 - 69		1,505	9,321	2,643	30	13,499	1,542	6,788	8,536		16,887
70–74		1,114	5,842	2,531	18	9,505	902	3,595	7,262		11,767
75 - 79	٠.	652	3,270	2,128	3	6,053	450	1,553	5,159	7	7,169
80 - 84	٠.	282	1,301	1,339	3	2,925		459	2,744		3,419
85 - 89		95	290	477		862		114	972		1,155
90 - 94	٠.	21	63	116		201	10	31	257		298
95 - 99		3	9	11		23	6	1	43		5(
100 & over	• •	1	1	2		4	1	2	- 9		12
TOTAL		502,495	286,643	23,336	1,134	813,608	513,365	302,496	63,432	1,428	880,72

In the total metropolitan population of the Commonwealth, females exceeded males by no less than 67,113, this excess being made up of 10,870 in the "never married," 15,853 in the married, 40,096 in the widowed, and 294 in the divorced.

The following table contains similar particulars in respect of the extra-metropolitan population:—

Age and Conjugal Condition of the Extra-Metropolitan Population of the Commonwealth, 1911.

AGE LAST				MALES.				FEM	IALES.		
BIRTHDAY.		Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL.	Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL.
Under 15		470,240	. 1			470,241	454,545	13		.	454,55
15-19		145,646	463	3	1	146,113	126,644	5,511	16		132,17
20-24	٠.	131,249	15,434	147		146,844	81,316	39,928	280	28	121,55
25 – 29		80,860	46,992			128,563	38,843	65,037	915	81	104,87
30 - 34	٠.	46,886	62,457	1,277	146	110,766	21,521	67,099	1,665	104	90,38
35 - 39		32,673	65,011	1,947	166	99,797	14,334	61,988	2,761	126	79,20
40 - 44		26,954	64,568			94,548	10,028	55,058	3,960	116	69,16
45 - 49	٠.	22,163	59,317			85,464		46,361	5,525	97	58,91
50 - 54	٠.	16,657	47,664			69,070		34,904	6,550	82	46,01
55 - 59	٠.	10,638	31,369	4,238		46,349	2,373	21,657	6,760	24	30,81
60 - 64		7,686	21,665			33,741	1,442	14,401	7,682	19	23,54
65-69		5,677	16,509			26,992	993	9,954	8,849	17	19,81
70-74	٠.	4,570	10,657			19,750		5,692	8,191	6	14,40
75 - 79	٠.	2,698	6,224	3,967	9	12,898		2,700	6,430	. 9	9,44
80 - 84	٠.	1,115	2,412			. 5,938		877	3,309	2	4,32
85-89	٠.	371	582			1,789	53	190	1,321	1	1,56
90 - 94		87	113	238	2	440	11	37	358		40
95 - 99		26	18	48	1	93	3	3	71		7
100 & over	٠.	7	9	15	• •	31	1	1	15	• •	]
TOTAL		1,006,203	451,465	40,525	1,234	1,499,427	764,468	431,411	64,658	712	1,261,24

In the total extra-metropolitan population males exceeded females by 238,178, comprising an excess of 241,735 amongst the "never married," 20,054 amongst the married, 522 amongst the divorced, and a defect of 24,133 amongst the widowed.

The proportions per 10,000 of each sex in each age-group belonging to the several conjugal conditions are shewn in the next table, the basic figures being the metropolitan figures for the Commonwealth for the census of 1911:—

Metropolitan Conjugal Condition.—Proportion per 10,000 in each Age-group.

AGE LAST			MALES.					FEMALES	3.	
BIRTHDAY.	Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL.	Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL
Under 15	10,000				10,000	10,000		.,		10,000
15–19	9,948	52			10,000	9,673	326	1		10,000
20-24	8,503	1,483	12	2	10,000	7,376	2,598	22	4	10,000
25-29	5,392	4,537	60	11	10,000	4,664	5,226	92	18	10,000
30–34	3,418	6,430	129	23	10,000	3,293	6,454	221	32	10,000
35–39	2,515	7,233	223	29	10,000	2,570	6,922	468	40	10,000
40-44	1,995	7,652	318	35	10,000	2,012	7,147	797	44	10,000
45– $49$	1,581	7,909	472	38	10,000	1,589	7,111	1,256	44	10,000
50-54	1,373	7,915	671	41	10,000	1,396	6,735	1,832	37	10,000
55–59	1,208	7,793	961	38	10,000	1,181	6,116	2,682	21	10,000
60-64	1,183	7,413	1,370	34	10,000	1,033	5,131	3,817	19	10,000
65-69	1,115	6,905	1,958	22	10,000	913	4,020	5,055	12	10,000
70-74	1,172	6,146	2,663	19	10,000	767	3,055	6,171	7	10,000
75–79	1,077	5,402	3,516	5	10,000	628	2,166	7,196	10.	10,000
80-84	964	4,448	4,578	10	10,000	632	1,342	8,026		10,000
85 & over	1,101	3,330	5,560	9	10,000	- 568	977	8,455	• •	10,000
ALL AGES	6,176	3,523	287	14	10,000	5,829	3,435	720	16	10,000

Corresponding proportions per 10,000 of each sex in each age-group in respect of the extrametropolitan population are shewn in the next table :—

Extra-Metropolitan Conjugal Condition.—Proportion per 10,000 in each Age-group.

Age Last			MALES	•			I	EMALES	•	
BIRTHDAY.	Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	TOTAL.	Never Married.	Mar- ried.	Wid- owed.	Di- vorced.	Total.
Under 15	10,000				10,000	10,000				10,000
15–19	9,968	32			10,000	9,582	417	1		10,000
20-24	8,938	1,051	10	1	10,000	6,690	3,285	23	2	10,000
25– $29$	6,289	3,655	51	5	10,000	3,704	6,201	87	8	10,000
30–34	4,233	5,639	115	13	10,000	2,381	7,423	184	12	10,000
<b>35–39</b>	3,274	6,514	195	17	10,000	1,809	7,826	349	16	10,000
40–44	2,851	6,829	301	19	10,000	1,450	7,961	572	17	10,000
45-49	2,593	6,941	440	26	10,000	1,176	7,869	938	17	10,000
50-54	2,412	6,901	662	25	10,000	973	7,586	1,423	18	10,000
55-59	2,295	6,768	914	23	10,000	770	7,028	2,194	8	10,000
60-64	2,278	6,421	1,280	21	10,000	612	6,117	3,263	8	10,000
<b>65</b> –69	2,103	6,116	1,764	17	10,000	501	5,024	4,466	9	10,000
70-74	2,314	5,396	2,277	13	10,000	361	3,950	5,685	4	10,000
75-79	2,092	4,825	3,076	7	10,000	319	2,860	6,811	10	10,000
80-84	1,878	4,062	4,042	18	10,000	308	2,029	7,658	5	10,000
85 & over	2,087	3,068	4,824	21	10,000	329	1,119	8,547	5	10,000
ALL AGES	6,711	3,011	270	8	10,000	6,061	3,420	513	6	10,000

Amongst males the proportion "never married" was considerably higher in all age-groups in the extra-metropolitan than in the metropolitan population, while the reverse was the case amongst females, the metropolitan "never married" being in this case represented by much the higher proportions.

On the other hand, the proportions of married males at the various ages was much higher in the metropolitan than in the extra-metropolitan area. Similarly, the proportions of married females at various ages was much lower in all age-groups in the metropolitan than in the extra-metropolitan area.

Further, the proportion of widowers in each age-group was slightly the higher in the metropolitan area, as was also the case practically throughout for widows, as well as for divorced persons of both sexes.

7. Average Ages.—In the following table are given particulars of the average ages of persons of each sex of the several conjugal conditions, who were aged 15 and upwards at the census of 3rd April, 1911. The particulars are shewn separately for the metropolitan areas, the extra-metropolitan areas, and the whole area of the Commonwealth and the several States:

Conjugal Condition and Average Age of Persons Aged 15 and Upwards.

Married				_							
Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Never Married   Wid-owed   Vorced   All   Wester Married   Wid-owed   Vorced   All   Wester Married   Wid-owed   Vorced   All   Wester Married   Wid-owed   Vorced   All   Wester Married   Wid-owed   Vorced   All   Wester Married   Wid-owed   Vorced   All   Wester Married   Wid-owed   Wester Married   Wid-owed   Wester Married   Wid-owed   Wester Married   Wid-owed			M	ALES.				F	EMALES.	•	
Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vears   Vear	Particulars.		Married			All.		Married			All.
Sydney and Suburbs				METR	OPOLIT	'AN AR	EA.				
Melbourne and Suburbs       26.87       44.29       60.68       45.22       37.06       27.56       41.00       60.72       42.20       3 Brisbane and Suburbs       25.76       44.18       59.23       44.13       36.15       25.10       40.83       58.86       40.89       3 Adelaide and Suburbs       26.17       44.15       61.50       44.15       61.50       44.13       36.15       25.10       40.83       58.86       40.89       3 Adelaide and Suburbs       26.21       44.16       61.50       46.13       37.01       26.91       41.08       61.77       42.50       3 39.07       3 38.90       7 38.90       3 37.01       26.91       41.08       62.71       40.71       3 38.00       3 37.49       27.97       41.08       62.71       40.71       3 40.07       3 38.00       43.43       36.72       26.80       40.32       59.89       41.41       3 38.00       3 36.72       26.80       40.32       59.89       41.41       3 38.00       43.43       43.43       43.43       37.01       24.54       39.45       60.63       41.74       3 43.23       36.72       26.80       40.32       59.89       41.41       3 38.00       33.30       36.72       26.80       40.32       59.89       41.41	4	years.	years.	years.	years.	years.	years.	years.	years.	years.	years
Brisbane and Suburbs 25.76 44.18 59.23 44.13 36.15 25.10 40.83 58.86 40.89 3 Adelaide and Suburbs 26.17 44.15 61.50 46.13 37.01 26.91 41.08 61.76 42.50 3 Perth and Suburbs 26.20 44.46 62.97 43.83 37.49 27.97 41.08 62.71 40.71 3 Hobart and Suburbs 26.20 44.46 62.97 43.83 37.49 27.97 41.08 62.71 40.71 3 All Metropolitan 26.91 43.66 59.68 45.33 36.72 26.80 40.32 59.89 41.41 3 EXTRA-METROPOLITAN AREA.  EXTRA-METROPOLITAN AREA.  New South Wales 29.26 43.88 60.21 47.43 37.01 24.54 39.45 60.63 41.74 3 Victoria 28.96 45.63 63.11 48.86 37.92 26.36 41.32 63.02 43.24 3 Queensland 30.05 43.74 58.66 43.13 36.73 23.17 39.06 58.44 41.97 3 South Australia 27.09 44.68 60.93 47.01 36.38 24.52 40.64 63.08 45.60 3 Western Australia 26.87 43.93 60.16 47.85 36.60 25.04 39.62 61.28 42.50 3 Northern Territory 43.99 47.60 53.28 52.50 45.01 22.41 36.12 49.87 3 Federal Territory 47.10 47.56 56.83 72.50 37.80 22.59 42.13 61.96 42.50 3 All Extra-Metropolitan 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3 Characteristic 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3 Characteristic 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3 Characteristic 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3 Characteristic 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3 Characteristic 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3 Characteristic 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3 Characteristic 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3 Characteristic 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3 Characteristic 28.10 45.01 62.04 46.64 37.55 26.98 41.17 61.82 42.50 3 Characteristic 28.10 45.01 62.04 46.64 37.55 26.98 41.17 61.82 42.50 3 Characteristic 28.10 45.01 62.04 46.81 36.61 23.78 39.52 58.58 41.62 3 Characteristic 28.10 45.01 62.04 46.81 36.61 23.78 39.52 58.58 41.62 3 Characteristic 28.10 45.01 62.04 46.81 36.61 23.78 39.52 58.58 41.62 3 Characteristic 29.29 44.23											36.05
Adelaide and Suburbs 26.17 44.15 61.50 46.13 37.01 26.91 41.08 61.76 42.50 3 Perth and Suburbs . 28.68 42.34 56.02 45.36 36.83 25.04 38.92 56.52 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07 39.07											37.10
Perth and Suburbs   28.68   42.34   56.02   45.36   36.83   25.04   38.92   56.52   39.07   3											35.64
Hobart and Suburbs   26.20   44.46   62.97   43.83   37.49   27.97   41.08   62.71   40.71   3   3   3   3   3   3   3   3   3											37.17
EXTRA-METROPOLITAN AREA.    New South Wales											35.36
EXTRA-METROPOLITAN AREA.  New South Wales 29.26	Hobart and Suburbs	26.20	44.46	62.97	43.83	37.49	27.97	41.08	62.71	40.71	37.34
New South Wales	All Metropolitan	26.91	43.66	59.68	45.33	36.72	26.80	40.32	59.89	41.41	36.51
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			EX	TRA-M	ETROP	OLITAN	AREA.				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	New South Wales	29.26	43.88	60.21	47.43	37.01	24.54	39.45	60.63	41.74	35.36
South Australia   27.09	Victoria	28.96	45.63	63.11	48.86	37.92	26.36	41.32	63.02	43.24	37.31
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Queensland	30.05	43.74	58.66	43.13	36.73	23.17	39.06	58.44	41.97	34.43
Tasmania		27.09	44.68	60.93	47.01		24.52	40.64			35.97
Northern Territory 43.99 47.60 53.28 52.50 45.01 22.41 36.12 49.87	Western Australia	31.44	41.87	53.19	43.92	36.38	24.35	37.44			34.66
Federal Territory 47.10 47.56 56.83 72.50 37.80 22.59 42.13 61.96 42.50 3  All Extra-Metropolitan 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3  THE WHOLE AREA.  New South Wales 28.55 43.54 59.61 46.45 36.79 25.49 39.53 59.75 41.30 3  Victoria 28.10 45.01 62.04 46.64 37.55 26.98 41.17 61.82 42.50 3  Queensland 29.29 43.85 58.78 43.35 36.61 23.78 39.52 58.58 41.62 3  South Australia 26.72 44.43 61.19 46.52 36.66 25.78 40.86 62.32 43.57 3  Western Australia										42.50	35.79
All Extra-Metropolitan 29.29 44.23 60.29 46.79 37.09 24.89 39.86 61.13 42.00 3  THE WHOLE AREA.  New South Wales 28.55 43.54 59.61 46.45 36.79 25.49 39.53 59.75 41.30 3  Victoria 28.10 45.01 62.04 46.64 37.55 26.98 41.17 61.82 42.50 3  Queensland 29.29 43.85 58.78 43.35 36.61 23.78 39.52 58.58 41.62 3  South Australia 26.72 44.43 61.19 46.52 36.66 25.78 40.86 62.32 43.57 3  Western Australia 30.74 42.04 54.11 44.41 36.52 24.70 38.07 55.95 38.28 3  Tasmania 26.75 44.04 60.78 46.81 36.77 25.89 39.94 61.72 41.76 3  Northern Territory 43.99 47.60 53.28 52.50 45.01 22.41 36.12 49.87 3											32.34
THE WHOLE AREA.  New South Wales $28.55$ $43.54$ $59.61$ $46.45$ $36.79$ $25.49$ $39.53$ $59.75$ $41.30$ $3$ Victoria $28.10$ $45.01$ $62.04$ $46.64$ $37.55$ $26.98$ $41.17$ $61.82$ $42.50$ $3$ Queensland $29.29$ $43.85$ $58.78$ $43.35$ $36.61$ $23.78$ $39.52$ $58.58$ $41.62$ $3$ South Australia $26.72$ $44.43$ $61.19$ $46.52$ $36.66$ $25.78$ $40.86$ $62.32$ $43.57$ $3$ Western Australia $30.74$ $42.04$ $54.11$ $44.41$ $36.52$ $24.70$ $38.07$ $55.95$ $38.28$ $3$ Tasmania $26.75$ $44.04$ $60.78$ $46.81$ $36.77$ $25.89$ $39.94$ $61.72$ $41.76$ $3$ Northern Territory $43.99$ $47.60$ $53.28$ $52.50$ $45.01$ $22.41$ $36.12$ $49.87$ $3$	Federal Territory	47.10	47.56	56.83	72.50	37.80	22.59	42.13	61.96	42.50	36.14
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	All Extra-Metropolitan	29.29	44.23	60.29	46.79	37.09	24.89	39.86	61.13	42.00	35.81
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		ı	<u> </u>	TI	HE WH	DLE AR	EA.	1		1	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	New South Wales	28 55	43 54	59.61	46 45	36 79	25 49	39 53	59 75	41 30	35.67
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	\$7° -4° -	90.10									37.2
South Australia      26.72     44.43     61.19     46.52     36.66     25.78     40.86     62.32     43.57     3       Western Australia      30.74     42.04     54.11     44.41     36.52     24.70     38.07     55.95     38.28     3       Tasmania       26.75     44.04     60.78     46.81     36.77     25.89     39.94     61.72     41.76     3       Northern Territory      43.99     47.60     53.28     52.50     45.01     22.41     36.12     49.87      3											34.7
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	N 17 A 1 11	00 =0									36.59
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Northern Territory 43.99   47.60   53.28   52.50   45.01   22.41   36.12   49.87     3	Dagesia	90 55					11				36.1
											32.3
·											36.1
Commonwealth 28.52 44.01 60.07 46.09 36.96 25.78 40.05 60.52 41.61 3		-			·	ļ	.			·	36.13

In the case of males for the Commonwealth as a whole, the average age was somewhat lower in each conjugal condition in the metropolitan than in the extra-metropolitan area, and the same was true amongst females in the case of widows and divorcees. On the other hand, the average ages of "never married" and married females was somewhat higher in the metropolitan than in the extra-metropolitan area.

It will be noticed also that the difference in average age of married males and married females is lower in all metropolitan areas than in the corresponding extra-metropolitan areas. In the case of the metropolitan areas this difference ranged between the limits of 3.07 in Adelaide, and 3.42 in Perth, and for the Commonwealth as a whole was 3.34. In the extra-metropolitan areas, leaving the Territories out of account, the range was between the limits of 4.04 in South Australia, and 4.68 in Queensland, with a difference of 4.37 for the Commonwealth as a whole.

## CHAPTER XIX. FAMILIES.

1. Collection, Tabulation, and Publication of Data.—The information combined in the present report under the head of Families comprises particulars concerning:

(i.) Relative ages of husbands and wives :

(ii.) Relative birthplaces of husbands and wives; (iii.) Relative religions of husbands and wives;

(iv.) Issue of husbands according to age;

(v.) Issue of wives according to age; (vi.) Issue of wives according to birthplace;

(vii.) Issue of wives according to religion;

(viii.) Issue of wives according to duration of marriage;

(ix.) Average issue of husbands according to age; (x.) Average issue of wives according to age

(xi.) Average issue of wives according to birthplace and age;

(xii.) Average issue of wives according to religion and age;

(xiii.) Average issue of wives according to duration of marriage and age;

(xiv.) Average issue of husbands according to occupation;

(xv.) Average issue of widowers according to age;

(xvi.) Average issue of widows according to age;

(xvii.) Average issue of divorced males according to age;

(xviii.) Average issue of divorced females according to age.

In all cases the particulars have been published for the Commonwealth as a whole, and also separately for each State and Territory. The only cases in which the details for States and Territories are given less extensively than those for the Commonwealth as a whole is that of the relative birthplaces of husbands and wives, where a condensation of the less important birthplaces was effected in the information relating to States and Territories, and that dealing with the actual size of family, which is given fully in Volume III. for the Commonwealth as a whole, and briefly summarised in the present chapter for States and Territories. The full details published concerning Families are contained in Volume III., pp. 1103 to 1205.

The major portion of the data used in the compilation of the information specified above was that contained on the "Conjugal Condition Card," which, as mentioned in Chapter VIII., p. 82, was written up from the personal cards before the segregation of the latter, according to The form of the card was as shewn hereunder:

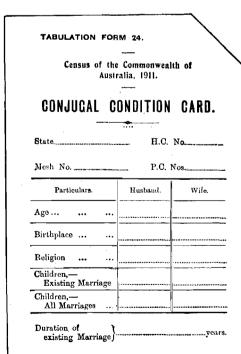
The abbreviations "H.C. No." and "P.C. Nos." stand for "Householder's Card No." and

"Personal Card Nos.," and the particulars were given to associate the "Conjugal" cards with the schedules from which the data had been obtained.

These cards were written for all married, widowed, and divorced persons. Where a husband and wife were together at the time of the Census the same "Conjugal" card served for both, and furnished the data requisite for the compilation of statistics of relative ages, birthplaces and religions of husbands and wives. Where the personal card of a husband was not associated with that of his wife, the husband's particulars were inserted on a "Conjugal" card, and the word "Absent" was written across the space provided for particulars concerning the wife, a corresponding course being followed where the personal card of a wife was not associated with that of her husband. Similarly in the cases of widowers and divorced males, the words "dead" and "divorced" respectively were written across the spaces provided for particulars concerning the wife, and a corresponding course was followed in the cases of widows and divorced

The only information specified above which was not obtainable from the "Conjugal" card was that relating to the average issue of husbands according to occupation. The item of occupation of husband was omitted from the "Conjugal" card because at the stage at which these cards were being written up the occupations had not been classified. The information concerning average

issue of husbands according to occupation was accordingly tabulated from the male personal cards, when the general occupation tabulation was in progress.



It will thus be seen that in all cases the fullest information available was used, and whilst in the cases of relative ages, birthplaces and religions of husbands and wives, the information was necessarily restricted to those instances in which husbands and wives were together at the time of the Census, the information in respect of issues and average issues was tabulated in respect of all husbands, wives, etc., who furnished the requisite data.

2. Relative Ages of Husbands and Wives.—On pp. 1106 and 1107 of Volume III. are given particulars in single ages to 20, and thereafter in grouped ages, mainly quinquennial, concerning the relative ages of husbands and wives for the Commonwealth as a whole. Similar particulars for the several States and Territories are given on pp. 1112 to 1119 of Volume III.

The following table furnishes, for the Commonwealth as a whole, a summary of these particulars for some important age-groups.

Ages of		Agı	es of Wi	VES LAST	BIRTHDA	Y.		Number	R OF HU	SBANDS.
Husbands Last Birthday.	Under 15	15-19	20-44	45-59	60-64	65 and over.	Unspeci- fied.	Whose Wives were with them.	Whose Wives were absent.	Total.
Under 15 15-19 20-44 45-59 60-64 65 & over Unspecified	6	356 6,747 49 3 2	245 340,271 74,941 1,994 1,498 1,559	9,637 107,669 17,191 12,100 622	75 3,057 6,551 9,956 76	45 846 1,795 21,704 80	 6 2,157 1,382 202 361 506	607 358,938 187,944 27,736 45,621 2,874	3 282 54,517 38,754 6,980 10,548 1,045	3 889 413,455 226,698 34,716 56,169 3,919
No. of wives whose hus- bands were with them No. of wives whose hus- bands were absent	13	7,188 1,189	420,508 62,372	147,219 32,859	19,715 5,144	24,470 7,315	4,614 1,161	623,720 110,053	112,129	735,849
Total	19	8,377	482,880	180,078	24,859	31,785	5,775	733,773		

Relative Ages of Husbands and Wives, Commonwealth, 1911.

Of the total of 735,849 males recorded as married, there were 112,129, or 15¼ per cent., whose wives were absent, while in the case of the 733,773 females recorded as married, there were 110,053, or 15 per cent., whose husbands were absent. These cases of absence include of course instances of judicial or other separation of a permanent character, but the majority of cases are merely due to the fact that at the time of the Census the wife was at home and the husband was temporarily absent therefrom for business or other purposes. The proportions absent differed somewhat in the several States and Territories, as will be seen from the following table:—

Proportion per cent. of-			Sta	TES.			TERRIT		C'wlth
	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	
Married males whose wives were absent Married females whose husbands were absent	% 15.15 15.39	% 12.58 14.49	% 18.38 16.09	% 11.54 11.90	% 26.06 18.11	% 13.82 14.10	% 69.74 15.94	% 27.54 14.16	% 15.24 15.00

Proportion of Absentees per cent., Census 1911.

In New South Wales, Victoria, South Australia, and Tasmania, the proportion of married females whose husbands were absent exceeded the proportion of married males whose wives were absent, while the opposite was the case in Queensland, Western Australia, the Territories, and the Commonwealth as a whole. Amongst the States the greatest divergence in this respect occurred in the case of Western Australia and the least in that of New South Wales.

The following table furnishes particulars concerning the relation between absenteeism and age for both husbands and wives :—

	_	_		
Ahgenteeigm	and	Aga	.Commonwoolth	1011

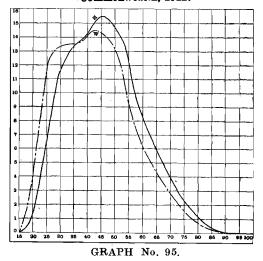
		Husbands in e Wives	ach Age-group whose were Absent.	Wives in each Age-group whose Husbands were Absent.				
Age-group.		Number.	Proportion per cent. of Husbands in Age-group.	Number.	Proportion per cent of Wives in Age-group.			
Jnder 15		3	100.00	13	% 68.42			
15–19		282	31.72	1,189	14.19			
20-24	٠.	3,677	13.38	7,858	12.15			
25–29		9,477	11.95	13,001	12.00			
30-34		12,602	12.45	13,456	12.05			
35–39		13,753	13.41	13,727	13.25			
40-44		15,008	14.58	14,330	15.15			
45–49		15,214	15.70	13,838	16.97			
50-54		13,825	17.62	11,531	18.92			
55–59		9,715	18.92	7,490	19.93			
60-64		6,980	20.11	5,144	20.69			
65–69		4,943	19.29	3,587	21.57			
70–74		2,980	18.21	2,058	22.31			
75–79		1,665	17.68	1,073	25.38			
80-84		702	19.05	414	31.22			
85–89		181	20.90	143	47.35			
90-94		60	34.29	34	50.00			
95–99		10	37.04	3	75.00			
100 and over		7	70.00	3	100.00			
Unspecified	• •	1,045	26.66	1,161	20.10			
TOTAL		112,129	15.24	110,053	15.00			

For both sexes there was in evidence a strikingly regular variation with age in the proportion of absentees. In the case of males the progression was wavelike, descending rapidly from the earliest age to the group 25-29, ascending thence to 60-64, descending from this latter group to 75-79, and ascending thereafter throughout. In the case of females the variation was even simpler, and comprised a descent from the earliest ages to the group 25-29, and an ascent thereafter.

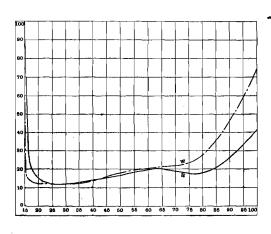
In both sexes the minimum proportion of absenteeism was in the group 25-29, being 11.95 per cent. for husbands in that group, and 12 per cent. for wives in the same group.

In the accompanying graph, No. 95, is furnished a representation of the number of husbands and wives at each age who were absent from their wives and husbands respectively at the date of the Census. The continuous line marked H represents the number of husbands who were so absent, and the broken line marked W represents the number of absentee wives. The base of each small square represents 5 years of age, and the height represents 200 persons. The number at any age will consequently be found by ascertaining from the marginal scale the vertical height of the curve for the age in question, and multiplying that height by 200.

Number and Age of Absentees. Commonwealth, 1911.



Percentage and Age of Absentees. Commonwealth, 1911.



GRAPH No. 96.

In Graph No. 96 is furnished a representation for each age of the proportion per cent. of husbands and wives of such age who were absent from their wives and husbands respectively at the date of the Census. The base of each small rectangle represents five years of age, and the height represents 10 per cent.

In the succeeding table a statement is furnished of the number and proportion of husbands who had wives in the same age-group as themselves, or whose wives belonged to lower or higher groups. The figures relate to the Commonwealth as a whole.

Wives' Ages in Relation to those of their Husbands, Commonwealth, 1911.

					Husbani	os whose '	WIVES BELO	NGED TO-		
				Lower A	ge-group.	Same A	ge-group.	Higher .	Age-group.	
Ages of	F Н	USBAI	nds.	Number.	Percentage on Total Husbands in Age-group.	Number.	Percentage on Total Husbands in Age-group.	Number.	Percentage on Total Husbands in Age-group.	TOTAL HUSBANDS
					%		%		%	
15–19				• •	• • •	356	59.23	245	40.77	601
20–24				3,564	15.06	14,811	62.60	5,287	22.34	23,662
25–29				27,093	38.98	33,512	48.21	8,905	12.81	69,510
30-34				45,025	51.10	33,771	38.33	9,309	10.57	88,105
35–39				50,490	57.25	29,536	33.48	8,173	9.27	88,199
40-44				52,197	59.79	27,421	31.41	7,687	8.80	87,305
45-49				49,863	61.49	24,721	30.48	6,510	8.03	81,094
50-54				41,336	64.41	18,327	28.56	4,512	7.03	64,175
55-59				28,268	68.46	10,342	25.04	2,683	6.50	41,293
60-64		٠.		19,188	69.69	6,551	23.79	1,795	6.52	27,534
65-69				14,592	71.11	4,711	22.96	1,216	5.93	20,519
70-74				9,791	73.66	2,796	21.03	706	5.31	13,293
75–79				6,026	78.46	1,380	17.97	274	3.57	7,680
80-84				2,489	84.06	404	13.64	68	2.30	2,961
85-89				615	91.11	56	8.30	4	0.59	675
90-94				110	97.35	3	2.65			113
95-99				17	100.00			١		17
100 and c	ver	• •	• •	2	100.00		••		••	2
ALL A	Ages	3		350,666	56.86	208,698	33.84	57,374	9.30	616,738

In this table only those cases have been included in which the husband and wife were enumerated together, and the ages of both were stated. In a tabulation based on a quinquennial grouping, it is not possible to ascertain exactly how many husbands had wives who were older or younger than themselves, or how many were of the same age; the best that can be done is to ascertain how many had wives who were in the same age-group or were in a lower or higher group. Husbands whose wives belong to a lower age-group than themselves are necessarily older than their wives, while those whose wives belong to a higher age-group than themselves are necessarily younger than their wives. Where husbands and wives are in the same age-group, however, some husbands will be older and some younger than their wives.

It will be seen that nearly 41 per cent. of the husbands between 15 and 20 had wives aged 20 or upwards, and about  $22\frac{1}{3}$  per cent. of those between 20 and 25 had wives who were aged 25

or upwards.

Items of special interest in this table are the continuous increase with age in the percentage of husbands whose wives belong to lower age-groups than themselves, and the practically continuous decrease with age in the corresponding percentages in the cases where the wives belonged to the same or a higher age-group than their husbands.

The next table contains corresponding particulars in respect of wives, and shews for the Commonwealth as a whole the number and proportion of wives who had husbands in the same age-group as themselves, or whose husbands belonged to lower or higher age-groups.

Husbands' Ages in Relation to those of their Wives, Commonwealth, 1911.

				Wives w	HOSE HUS	BANDS BELO	NGED TO-		
			Lower A	ge-group.	Same A	ge-group.	Higher .	Age-group.	
Ages of Wives.		es.	Number.	Percentage on Total Wives in Age-group.	Number.	Percentage on Total Wives in Age-group.	Number.	Percentage on Total Wives in Age-group.	TOTAL WIVES.
TT1. 16	_			%		%	0	%	
Under 15 15–19	• •	• •	• •	••			6	100.00	6
00 04	• •	• •	214	.38	356	$4.97 \\ 26.18$	6,801 $41,538$	95.03 73.44	7,157
0× 00	• •	• •	4,445	.38 4.68	14,811	35.26	$\frac{41,338}{57,072}$	60.06	56,563 95,029
00 04	• •	• •	7,998	8.17	$33,512 \\ 33,771$	34.49	56,137	57.34	97,906
0 = 00	• •	• •	8,869	9.91	29,536	32.99	51,119	57.10	89,524
10 11	• •	• •	8,323	10.41	29,330 $27,421$	34.31	44,183	55.28	79,927
40–44 45–49	• •	• •	7,744	11.48	24,721	36.66	34,969	51.86	67,434
50-54	• •	• •	6,865	13,95	18,327	37.25	24,007	48.80	49,199
55-59	• •	• •	4,830	16.12	10,342	34.51	14,792	49.37	29,964
60-64	• •	• •	3,132	15.95	6,551	33.36	9,956	50.69	19,639
65-69	• •	• •	2,132	16.41	4,711	36.25	6,152	47.34	12,995
70-74	• •	• •	1,445	20.21	2,796	39.10	2,910	40.69	7,151
75–79	• •	• • •	891	28.35	1,380	43.91	872	27.74	3,143
80-84	• •		365	40.20	404	44.49	139	15.31	908
85–89	• •		90	56.60	56	35.22	13	8.18	159
90-94	• •		30	90.91	3	9.09			33
95-99	• •	• • •	1	100.00	_	-	• • •		1
100 and over					•••	•••			••
ALL AGES			57,374	9.30	208,698	33.84	350,666	56.86	616,738

FAMILIES. 265

This table exhibits a continuous increase with age in the proportion of wives whose husbands belonged to lower age-groups than themselves, and a practically continuous decrease with age in the proportion whose husbands belonged to higher age-groups than themselves, the increase in the one case, and the decrease in the other being most marked beyond age 75. In the case of wives whose husbands belonged to the same age-group as themselves, the proportion was relatively low at the extreme ages, and fluctuated somewhat at intermediate ages, but between ages 25 and 90 did not at any stage diverge very greatly from 35 per cent.

On the assumption that the relative seniority disclosed by the cases in which husbands and wives were in different age-groups is applicable to the cases in which they were in the same age-group, it may be roughly estimated that of 208,698 husbands in the same age-group as their wives, 179,353 were older, and 29,345 were younger than their wives. On this basis it would appear that at the date of the Census 86 per cent. of the husbands were older, and 14 per cent. were younger than their wives.

Another interesting aspect of the relative ages of husbands and wives is that obtained by computing for each group of ages of husbands the average ages of their wives. These have been computed separately for the several States and Territories, and are given in the succeeding table:—

Average	Ages	of	the	Wives	of	Husbands	of	Specified	Ages,	1911.

				Aver	AGE AGES	OF WIV	ES ENUM	ERATED I	N—-		
	F Husb. Birthd				Sta	ates.			Territo	C'wlth	
			N.S.W.	Vic.	Q'land.	S.A.	w.A.	Tas.	N.T.	F.T	
			Years.	Years.	Years.	Years.	Years.	Years.	Years.	Years.	Years
15						20.5					20.5
16			17.5	16.5	18.5	16.5					17.4
17			20.9	19.3	19.2	19.7	23.0	18.5			20.3
18			19.3	19.7	20.4	18.9	21.6	21.3			19.7
19			20.1	20.7	21.9	20.8	20.1	20.5			20.6
20	• • •		20.9	21.2	21.7	21.3	20.8	21.4			21.1
21-24			23.3	23.6	23.4	23.7	23.4	23.4	21.0	23.0	23.4
25-29			26.2	26.6	26.0	26.6	26.3	26.1	26.8	27.0	26.3
30-34			29.9	30.3	-29.5	30.2	30.0	29.7	28.9	28.4	30.0
35–39			33.8	34.3	33.5	34.1	34.0	33.7	31.8	33.7	33.9
10-44			38.0	38.7	37.8	38.7	38.1	38.2	34.5	38.1	38.3
15-49			42.6	43.2	42.5	43.1	42.2	42.8	40.8	40.6	42.8
60-54	• •		47.2	47.5	47.0	47.8	46.8	47.6	49.3	46.3	47.3
55-59	٠.		51.6	51.5	51.5	52.4	51.3	51.9	43.2	49.8	51.7
60-64			56.0	55.7	55.9	56.8	55.8	56.1	44.4	51.4	56.0
5–69			60.1	59.8	60.5	61.4	59.6	60.0	67.5	57.6	60.2
0-74			64.3	64.2	64.5	65.5	62.9	64.3	55.0	64.6	64.4
5–79			67.8	68.4	68.9	69.5	65.2	67.4	37.5	$\bf 72.5$	68.3
80-84	٠.		71.0	71.3	69.9	73.4	68.9	70.3	72.5	62.5	71.2
5–89			72.6	73.7	72.6	74.3	72.8	67.8		72.5	73.1
0-94	٠.		73.2	73.4	74.6	81.3	72.5	73.2			73.9
5-99			73.5	77.5		75.0	77.5	73.8			75.2
00 and	over	• •	67.5	• •	• •	• •	••	57.5	••	• •	62.5
ALL	Ages		39.1	40.7	39.1	40.5	37.5	39.5	36.5	41.6	39.6

The averages contained in this and the next table are probably, in most cases, slightly in excess of the true average age, since they have been computed on the assumption that the average age for a quinquennial group is the central point of that group, e.g., the average age for group 40-44 last birthday has been taken as  $42\frac{1}{2}$ . Such error is, however, practically eliminated, when, as is done later, the differences between average ages are taken.

Leaving out of account the Territories, in which cases the circumstances are exceptional, it will be seen that in no instance does the average for any State differ materially from the corresponding average for the Commonwealth, but that there is throughout a tendency for the South Australian averages to rank relatively high, and those for Queensland and Western Australia to be relatively low.

Amongst the States the average age of all wives whose ages were specified, and who were residing at the time of the Census with husbands for whom age statistics were available, ranged between 37.5 in Western Australia, and 40.7 in Victoria, with an average for the whole Commonwealth of 39.6.

The following table furnishes similar information concerning the average ages of the husbands corresponding to successive age-groups for wives:—

Average	Ασος	Λf	tha	Husbands	Λf	Wives	ωf	Specified	Ασρα	1911
MACIAGO	Ages	UΙ	ше	IIUSVALUS	UΙ	AA T A CO	UΙ	phecriten	Ages.	TOTT.

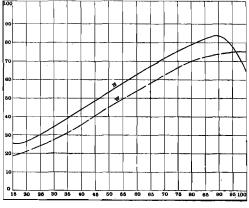
•			Aver	AGE AGES	s of Hus	BBANDS E	NUMERAT	ED IN-		
	of Wivi Birthd <i>e</i>			Sta	tes.			Territories.		C'wlth
*		N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	
		 Years.	Years.	Years.	Years.	Years.	Years.	Years.	Years.	Years
14		 21.8	24.0	23.0						22.9
15		 24.3	29.3	28.3	26.8	27.5	27.8			25.9
16		 25.7	25.1	25.6	24.1	26.4	26.8			25.6
17		 24.4	24.9	26.5	24.0	27.6	25.5	27.5		25.0
18		 25.4	25.4	26.6	25.5	27.7	25.6	30.3		25.7
19		 25.8	25.8	26.9	25.6	27.3	26.4	36.4	27.5	26.1
20		 26.3	26.7	27.6	26.5	27.8	27.1	47.5	32.5	26.7
21-24		 28.5	28.7	29.2	28.3	29.9	28.9	39.0	34.2	28.7
25-29		 32.1	32.3	32.5	31.5	33.2	32.6	37.5	33.6	32.2
30-34		 36.9	36.9	37.2	36.2	36.9	37.2	41.6	38.0	36.9
35-39		 41.7	41.7	41.8	41.3	40.9	41.6	45.4	44.4	41.6
10-44		 46.5	46.1	46.6	46.1	45.4	46.2	48.0	47.1	46.3
15-49		 51.1	50.6	51.1	51.2	49.7	50.7	51.9	53.4	50.9
50-54		 55.8	55.6	55.8	55.7	54.7	<b>3</b> 5.5	58.8	57.5	55.6
55-59		 60.4	60.9	60.6	60.3	59.4	60.0	58.8	60.8	60.5
30-64		 65.1	66.1	64.9	65.1	64.4	65.4	62.5	67.5	65.4
35-69		 69.4	70.9	69.3	69.5	68.8	69.5	67.5	70.0	69.8
0-74		 73.5	74.7	72.8	73.6	72.1	73.4	82.5	76.1	73.8
5-79		 76.8	77.9	75.3	77.2	77.7	76.4			77.1
80-84		 79.4	80.8	80.4	80.8	79.2	81.1			80.3
5-89		 81.5	84.4	81.6	84.5	83.8	78.9			83.3
0-94	٠.	 84.2	80.6	80.0	79.2		92.5			81.4
5-99	٠.	 	72.5					·		72.5
00 and	over	 		••					• •	
ALL	Ages	 43.1	44.7	43.4	44.2	41.5	43.6	44.9	47.4	43.7

In this case also the corresponding values for the several States vary within narrow limits, and consequently do not differ largely from the Commonwealth averages.

Amongst the States the average ages of all husbands whose ages were specified, and who were residing at the time of the Census with wives for whom age statistics were available, ranged between 41.5 in the case of Western Australia, and 44.7 in that of Victoria, with a Commonwealth average of 43.7.

The figures for all ages in the preceding tables indicate that on the average the ages of the husbands exceeded those of their wives by 4.3 years in the case of Queensland, 4.1 years in that

Relative Ages of Husbands and Wives. Commonwealth, 1911.



GRAPH No. 97.

of Tasmania, 4 years in the cases of New South Wales, Victoria, and Western Australia, and 3.7 years in the case of South Australia. For the Commonwealth as a whole the husbands' average exceeded that for wives by 4.1 years.

The accompanying Graph (No. 97) furnishes a representation of the average age of the wives of husbands of a given age, and also of the average age of the husbands of wives of a given age. The given age, whether for husbands or wives, is shewn on the base line for quinquennial intervals. The corresponding average ages of husbands are represented by the continuous curve marked H, while those for wives are represented by the broken curve marked W. The base of each small rectangle represents 5 years of age, and the height 10 years of age.

The figures given in the two preceding tables enable a computation to be made of the average differences in age of husbands and wives in the

various age-groups for which the data have been tabulated. Assuming, as indicated above on p. 265, that the average age for any group is the central point of the group, the following table of average differences has been computed for the Commonwealth as a whole:—

FAMILIES.

Person	is wh	o compr ose Age y was—	last	Estimated Average Age of Group.	Average Age of Wives whose Husbands were in Age-group specified.	Average Excess of Age of Husband in Age-group specified over that of his Wife.	Average Age of Husband whose Wife was in Age- group specified.	Average Excess of Age of Wife in Age-group specified over that of her Husband.
		,		Years.	Years.	Years.	Years.	Years.
14				14.5			22.9	- 8.4
15			٠.	15.5	20.5	- 5.0	25.9	-10.4
16	٠.			16.5	17.4	9	25.6	— 9.1
17	٠.			17.5	20.3	2.8	25.0	<b>—</b> 7.5
18	٠.			18.5	19.7	— 1.2	25.7	-7.2
19	٠.			19.5	20.6	1.1	26.1	<b>— 6.6</b>
20				20.5	21.1	6	26.7	<b>—</b> 6.2
21 - 24				23.0	23.4	4	28.7	<b>—</b> 5.7
25-29				27.5	26.3	1.2	32.2	<b>— 4.7</b>
30 - 34	٠.			32.5	30.0	2.5	36.9	<b>— 4.4</b>
35 - 39				37.5	33.9	3.6	41.6	4.1
40 - 44				42.5	38.3	4.2	46.3	<b>— 3.8</b>
45 - 49				47.5	42.8	4.7	50.9	- 3.4
50 - 54				52.5	47.3	5.2	55.6	<b>— 3.1</b>
55 - 59				57.5	51.7	5.8	60.5	- 3.0
60 - 64				62.5	56.0	6.5	65.4	<b>— 2.9</b>
65 - 69				67.5	60.2	7.3	69.8	— 2.3
70 - 74	٠.			72.5	64.4	8.1	73.8	-1.3
75 - 79				77.5	68.3	9.2	77.1	.4
80 - 84		.,		82.5	71.2	11.3	80.3	2.2
85 - 89			٠.	87.5	73.1	14.4	83.3	4.2
90 - 94				92.5	73.9	18.6	81.4	11.1
95 - 99				97.5	75.2	22.3	72.5	25.0

Average Differences of Age between Husbands and Wives, Commonwealth, 1911.

<sup>1</sup> Minus sign (—) denotes average excess of age of wife over that of her husband.

40.0

<sup>2</sup> Minus sign (—) denotes average excess of age of husband over that of his wife.

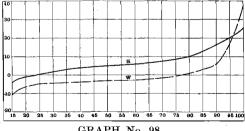
It will be seen that on the average husbands under the age of 25 had wives older than themselves, while husbands age 25 and upwards were on the average older than their wives. Further, leaving out of account husbands under the age of 17, of whom there were only 31 enumerated with their wives, it will be seen that from age 17 to the end of the table, there is a continuous progression with age in the average difference between the ages of husbands and those of their wives.

Similarly, wives in all age-groups under 75 were on the average younger than their husbands, while those above that age were on the average older than their husbands. Leaving out of account wives under the age of 15, of whom there were only 6 enumerated with their husbands, it will be seen that the remarkably regular progression with age in the average age differences noted in the case of husbands, is also in evidence in the case of wives.

It appears, therefore, that although as stated on p. 266, there is an average difference of 4.1 years between the ages of husbands and wives for all ages, when further details of ages are

Average Difference of Age, Husbands and Wives. Commonwealth, 1911.

100 and over



GRAPH No. 98.

considered, this difference is applicable only (approximately) to the group 40-44 for husbands, and to the group 35-39 for wives.

Graph No. 98 furnishes a representation of the average difference between the ages of husband and wife for any given age of the husband or for any given age of the wife. Such given ages are shewn on the base line for quinquennial intervals The continuous curve marked H represents the average difference for any given age of the husband, while the broken curve marked W represents the average difference for any given age of the wife. The scale shewn on the left

margin of the graph indicates the excess of the husband's age over that of the wife for the H curve, and the excess of the wife's age for the W curve. Where the wife's age is the greater on the H curve this difference is negative, and is shewn with a minus sign. Similarly, where on the W curve the husband's age is the greater the difference is negative, and is shewn with a minus sign.

3. Relative Birthplaces of Husbands and Wives.—Details respecting the relative birthplaces of husbands and wives are given on pp. 1108 to 1111, and 1128 to 1135 of Volume III. A summary of the information for the Commonwealth as a whole is contained in the succeeding table:-

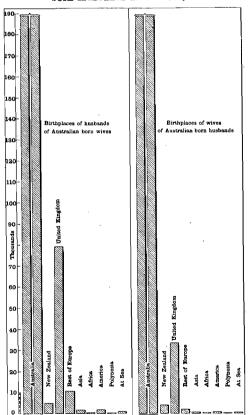
<u> </u>				Ві	RTHPLAC	ES OF V	Vives.		_		No.	of Husi	BANDS.
BIRTHPLACES OF HUSBANDS.	Aus- tralia.	New Zea- land.	United King- dom.	Rest of Europe.	Asia.	Africa,	Am- erica.	Poly- nesia.	At Sea.	Un- speci- fied.	Whose Wives were with them.	Whose Wives were absent,	Total.
Australia New Zealand United Kingdom Rest of Europe Asia Africa America Polynesia At Sea Unspecified	4,760 79,005 10,358 1,521 433 1,756 223 909	3,813 708 1,652 200 40 10 51 6 12 43	33,230 823 78,311 3,910 407 150 717 38 252 632	1,855 30 1,373 7,056 33 9 35	348 17 341 62 616 6 10 2 4	260 5 250 42 8 69 14 1 3 6	621 22 559 71 12 6 196 2 4	123 7 53 10 7 1 6 68	497 12 378 62 7 1 7  6	2,523 29 945 134 13 5 18 2 10 930	420,331 6,413 162,867 21,905 2,664 690 2,810 342 1,212 4,486	1,193 33,215 6,413 8,685 192 916 236 237	196,082 28,318 11,349 882 3,726 578 1,449
Whose husbands were with them Whose husbands	478,815	6,535	118,470	10,459	1,416	658	1,504	277	977	4,609	623,720	112,129	735,849
Whose husbands were absent	79,439	1,298	24,511	1,972	416	178	398	78	256	1,507	110,053		
• 1	558,254	7,833	142,981	12,431	1,832	836	1,902	355	1,233	6,116	733,773	•••	

Relative Birthplaces of Husbands and Wives, Commonwealth 1911.

Of the total of 623,720 cases in which husbands and wives were enumerated together, there were 615,555 cases in which the birthplaces of husbands and wives were both stated, 3679 in which that of the husbands only was stated, 3556 in which that of the wife only was stated, and 930 in which the birthplace of neither was stated.

Of the 615,555 cases for which full particulars were furnished, 377,061, or 61.3 per cent., were cases in which both parties were Australian born; 79,005, or 12.8 per cent. were cases in which the husband had been born in the United Kingdom, and the wife in Australia; 78,311, or

### Birthplaces of the Partners of Australianborn Husbands and Wives, 1911.



GRAPH No. 99.

12.7 per cent., were cases in which both parties were from the United Kingdom; and 33,230, or 5.4 per cent., were cases in which the husband was Australian-born and the wife was from the United Kingdom. It thus appears that intermarriages between parties born in Australia or in the United Kingdom accounted for 567,607, or 92.2 per cent., of the cases for which full particulars were available.

Of the remaining cases there were 12,168 in which one or both of the parties had been born in New Zealand; 18,904 in which one of the parties was Australian-born, and the other had been born elsewhere than in Australasia or the United Kingdom, and 8428 in which one of the parties had been born in the United Kingdom and the other had been born elsewhere than in Australia or the United Kingdom. There were thus, out of 615,555 couples, only 8488 cases, or about 1.4 per cent., in which both parties had been born elsewhere than in Australasia or the United Kingdom.

In Graph No. 99 is furnished a representation of the number of husbands from each specified birthplace who had married Australian-born wives, and also of the number of wives from each specified birthplace who had married Australian-born husbands. Owing to the great preponderance of Australian-born partners in each case, a double column has been given for the Australian-born to obviate the necessity for an excessively high graph.

Another method of presenting this information is that of shewing for each birthplace the number and proportion of cases in which husband and wife were from the same birthplace,

i.e., the number and proportion of marriages which from the standpoint of birthplace were unmixed. This information is furnished in detail in the next table:—

Marriages, "Unmixed," in respect of Birthplaces, Commonwealth, 1911.

Marriages, Ulmix	ea, m respect	of Direnplaces,	, соштопмея	110H, 1911.	
			siding toget	nich Husband her at time of a same Birthy	
	Number of	Number of	Iron	n same brunt	naces.
	Husbands of	Wives of			
	such Birth-	such Birth-			Percentage on
	places resid-	places resid-		total Hus-	total Wives
Birthplace.	ing at time	ing at time		bands from	from such
	of Census	of Census		such Birth	Birthplaces
	with Wives	with Hus-	Number.	places resid-	residing with
	whose	bands whose		ing with	Husbands
	Birthplaces	Birthplaces		Wives whose	whose
	were stated.	were stated.		Birthplaces	Birthplaces
				were stated.	were stated.
•					
AUSTRALASIA				%	%
Australia	417,808	476,026	377,061	90.25	79.21
New Zealand	6,384	6,492	708	11.09	10.91
EUROPE—	,	·			
England	101,886	69,692	39,253	38.53	56.32
Wales	3,657	2,534	753	20.59	29.72
Scotland	25,590	17,381	7,931	30.99	45.63
Ireland	30,789	28,231	13,414	43.57	47.52
Isle of Man	339	149	45	13.27	30.20
Other European British Poss	694	409	73	10.52	17.85
Austria-Hungary	574	216	134	23.34	62.04
Belgium	84	36		8.33	19.44
Denmark	1,975	846	457	23.14	54.02
France	718	344	109	15.18	31.69
Germany	10,671	6,127	3,923	36.76	64.03
Greece	219	50	41	18.72	82.00
Italy	1,316	700	606	46.05	86.57
Netherlands	185	50	21	11.35	42.00 39.23
Norway	987	209	82	8.31	
Portugal	81	6	1	1.23	$16.67 \\ 71.82$
Russia	1,203	621	446	37.07 $26.45$	47.76
Spain	121	67	32		50.84
Sweden	1,975	297	151   68	$7.65 \\ 14.08$	33.17
Switzerland	483 146	$\frac{205}{71}$	31	21.23	43.66
Other European Countries	140	/1	91	21.20	10.00
D. 111.1 T. 11.	1,064	685	49	4.61	7.15
Comless	113	48	3	2.65	6.25
TT TZ	39	18	2	5.13	11.11
Straits Settlements	47	19	Ī	2.13	5.26
Other Asiatic British Poss	19	6			
Afghanistan	14	l •		::	
Arabia	1 7	1			
China	798	203	181	22.68	89.16
Japan	121	91	72	59.50	79.12
Java	21	13	7	33.33	53.85
Philippine Islands	35	7	1	2.86	14.29
Syria	347	300	265	76.37	88.33
Other Asiatic Countries	26	15	6	23.08	40.00
AFRICA—					
Cape of Good Hope	117	141	3	2.56	2.13
Mauritius	185	101	28	15.14	27.72
Natal	29	39	1	3.45	2.56
Orange Free State	2	3.		••	••
Transvaal	3	6		10.74	
South Africa (undefined)	270	325	29	10.74	8.92
Other African British Poss	17	13		4.50	 5 99
Egypt	21	17	1	4.76	$5.88 \\ 14.29$
Other African Countries	41	7	1	2.44	14.48
AMERICA— Barbadoes	22	5	1	4.55	20.00
<b>a</b> 1	741	328	45	6.07	13.72
T .	72	24	2	2.78	8.33
NT	32	13	"	1	
Other American British Poss.	93	38	2	2.15	5.26
A time Deschlie	7	6			
Brazil	26	12			
Chile	21	10	::	·	
Mexico	12	8	1	8.33	12.50
Peru	5	5			
United States of America	1,617	985	123	7.61	12.49
Other American Countries	144	59			• •
POLYNESIA—				_	
Fiji	100	116	2	2.00	1.72
Friendly Islands	21	17			• • •
Papua	1	2		10.00	
Other Polynesian British Poss.	31	8	4	12.90	50.00
New Caledonia	35	54	7	20.00	12.96
New Hebrides	28	11	4	14.29	36.36
Samoa	25	14	5	20.00	$35.71 \\ 28.57$
Other Polynesian Islands	22	21	6	27.27	28.57 81.25
South Sea Islands (so described)	1 200	, 32	26	33.77	.62
AT SEA	1,202	970	6	.50	.02
ALL BIRTHPLACES	615,555	615,555	446,231	72.49	72.49
ALL BIRTHPLACES	019,999	010,000	440,231	12.40	
	<u> </u>	1	<u> </u>	<u> </u>	<u> </u>

Of the 67 birthplaces or birthplace groups dealt with in the above table, there were 14 cases in which no couples were recorded as having both come therefrom. Of the others there were 16 cases in which the number of unmixed marriages recorded amounted to 100 and upwards, and 8 in which they amounted to 500 and upwards. In this latter selection the proportions of males who were parties to unmixed marriages were: Australian, 90.25 per cent.; Italian, 46.05 per cent.; Irish, 43.57 per cent.; English, 38.53 per cent.; German, 36.76 per cent.; Scotch, 30.99 per cent.; Welsh, 20.59 per cent.; and New Zealand, 11.09 per cent. The corresponding proportions amongst females in the same group of birthplaces were; Italian, 86.57 per cent.; Australian, 79.21 per cent.; German, 64.03 per cent.; English, 56.32 per cent.; Irish, 47.52 per cent.; Scotch, 45.63 per cent.; Welsh, 29.72 per cent.; New Zealand, 10.91 per cent.

In the following table are given, for the Commonwealth as a whole, particulars in respect of absenteeism and birthplaces for both husbands and wives:—

Absenteeism and Birthplace, Commonwealth, 1911.

			•				place whose	of each Birth- e Wives were bsent.	Wives of each Birth- place whose Husbands were Absent.			
	Bir	THPLAC	Е.			-	Number.	Proportion per cent. of Husbands of each Birthplace.	Number.	Proportion per cent. o Wives of each Birthplace.		
AUSTRALAS					-		**************************************					
Commonwe						į	01.045	%	20 701	%		
New Sou		aies	• •	• •	• •	• •	21,945	12.87	29,504	14.79		
Victoria	;•	• •	• •	• •	• •	• • •	20,050	12.01	26,113	13.79		
Queensla			• •	• •	• •	• • •	4,492	12.43	7,233	14.84		
South A			• •		• •	• •	6,858	10.79	8,669	12.22		
Western		ralia		• •		٠.	1,007	15.98	1,484	17.35		
Tasmani				• •			4,086	13.54	5,033	15.09		
Northern				• •	• •		12	40.00	8	16.33		
Australia		lefined)	٠.	1	• •		985	16.17	1,395	17.65		
New Zeala	nd	• •			• • •		1,193	15.68	1,298	16.57		
EUROPE—												
England					• •		20,769	16.84	13,337	15.99		
Wales		• •					718	16.34	<b>464</b>	15.43		
Scotland							5,443	17.48	3,435	16.44		
$\mathbf{Ireland}$							6,285	16.88	7,275	20.40		
Isle of Man							72	17.48	28	15.73		
Other Euro	pean :	British l	Posses:	sions			174	19.91	81	16.43		
Austria-Hu	ngary						549	48.67	36	14.23		
Belgium						٠.	36	30.00	11	23.40		
Denmark							416	17.35	167	16.47		
France							273	27.41	94	21.32		
Germany							2,049	16.04	1,110	15.28		
Greece	٠.,						270	54.99	15	23.08		
Italy							1,096	45.23	121	14.63		
Netherland	s						67	26.38	11	18.03		
Norway					٠.		349	25.91	51	19.47		
Portugal							14	14.58	$\overset{\circ}{2}$	22.22		
Russia							320	20.92	$9\overline{2}$	12.80		
Spain							50	28.90	17	20.24		
Sweden							466	18.99	64	17.68		
Switzerland	i						142	22.65	58	21.89		
Other Euro							70	31.96	14	16.47		
Asia	• • •						8,685	76.53	416	22.71		
Africa							192	21.77	178	21.29		
America							916	24.58	398	20.93		
Polynesia							236	40.83	78	21.97		
At Sea						• • •	237	16.36	256	20.76		
Unspecified		••					1,607	26.37	1,507	24.64		
ALL BIR	THPLA	CES					112,129	15.24	110,053	15.00		

Of those born in the Australian States the lowest percentages of absenteeism for both husbands and wives occurred in the case of those born in South Australia, being 10.79 per cent. for husbands, and 12.22 per cent. for wives. The highest proportion for the Australian States occurred in the case of those born in Western Australia, the proportions being 15.98 per cent. for husbands, and 17.35 per cent. for wives.

Amongst those born in other countries heavy proportions of absenteeism occurred in the case of husbands born in Asia, 76.53 per cent.; in Greece, 54.99 per cent.; in Austria-Hungary, 48.67 per cent.; in Italy, 45.23 per cent.; and in Polynesia, 40.83 per cent. Amongst wives there was no case in which the proportion reached 25 per cent., the highest proportion for any birthplace represented by upwards of 1000 wives whose husbands were absent being that of 20.4 per cent. in the case of wives born in Ireland.

4. Relative Religions of Husbands and Wives.—Full particulars concerning the relative religions of husbands and wives for the Commonwealth as a whole, and separately for the several States and Territories are given on pp. 1106 and 1107, and on pp. 1120 to 1127 of Volume III. The following table furnishes a summary for the Commonwealth in respect of the denominations and religions most numerously represented:—

Relative Religions of Husbands and Wives, Commonwealth, 1911.

	1						Derre		Mann						Mo o	n Uran	
	Religions of Wives—														. OF HUSBANDS		
RELIGIONS OF HUSBANDS.	Church of England.	Presbyterian.	Methodist.	Baptist.	Congrega- tional.	Lutheran.	Church of Christ.	Salvation Army.	Protestant (undefined).	Roman Catholic.	Catholic (undefined).	Other Christians.	Hebrew.	Others (includ'g Object to State and Unspecified).	Whose Wives were with them.	Whose Wives were Absent.	Total.
Church of England Presbyterian Methodist Baptist Congregational Lutheran Church of Christ Salvation Army	1,424 1,273	1,958 416 332	7,438 2,524 68,186 720 404 429 154 218	1,778 723 742 11,230 168 114 57 42	1,085 342 270 144 8,813 59 27 6	461 131 140 58 17 9,099 14	700 231 266 88 58 36 4,573	291 90 206 42 18 19 6 3,159	77 59 91 22	$\begin{pmatrix} 19,351\\4,369\\1,521\\276\\277\\629\\56\\26 \end{pmatrix}$	2,270 531 235 41 35 82 13	572 217 186 57 45 33 35	193 45 12 4 5 4 1	1,335 432 364 105	245,902 82,091 80,573 14,682 11,566 12,654 5,401 3,705	42,233 13,243 8,558 1,665 1,162 1,874 568 496	95,334 89,131 16,347 12,728
Protestant (unde- fined Catholic Catholic Undefined) Other Christians Hebrew Others (including Object to State	838 459	2,133 301 208 66	654 1,280 222 235 41	220 41 79 8	125 159 23 62 9	55 161 27 72 7	77 79 14 40 5	34 27 6 15	638 203 45 25	$\begin{array}{r} 85,187 \\ 1,172 \\ \hline 200 \\ 144 \end{array}$	440 1,093 5,444 23 27	$\frac{12}{4,602}$	2,210	544 80 129 41	9,177 6,549 3,050	4,911 19,766 1,927 1,434 614	22,936 124,089 11,104 7,983 3,664
Whose Husbands were with them Whose Husbands were	245,724	78,466	,	,	11,452	,	,	ŕ	15,536	117,938	10,589	6,250		13,868	623,720	13,678	
o Absent	45,503 291,227	12,803 91,269		<u> </u>	1,392 12,844			751 4,771		<u> </u>	2,464 13,053	1,098 7,348			110,053 733,773		

As would naturally be expected, by far the largest groups shewn in this table are those in which husband and wife were members of the same denomination, i.e., the majority of marriages were "unmixed," and this is more fully indicated in the next table. There are, however, some fairly heavy lists of "mixed" marriages, those most numerously represented being as follows:

Church of England husbands with Roman Catholic wives, 19,351; Roman Catholic husbands with Roman Catholic hu

Church of England husbands with Roman Catholic wives, 19,351; Roman Catholic husbands with Church of England wives, 12,688; Presbyterian husbands with Church of England wives, 12,262; Church of England husbands with Presbyterian wives, 10,449; Church of England husbands with Methodist wives, 7438; Methodist husbands with Church of England wives, 6131.

In each religion and denomination shewn in the above table there were amongst the "mixed" marriages a larger number of husbands who had married wives belonging to the Church of England, and a larger number of wives who had married husbands belonging to the Church of England, than there were of husbands or wives respectively married to members of any other denomination, except in the case of Salvation Army husbands, where Methodist wives predominated amongst mixed marriages.

In the succeeding table are shewn for each religion and denomination the number and proportion of cases in which husband and wife were of the same religious belief, *i.e.*, the number and proportion of marriages which, from the standpoint of religion, were "unmixed":—

Marriages, "Unmixed," in respect of Religion, Commonwealth, 1911.

		Number of Husbands of	Number of Wives of	Cases in which Husband and Wife Residing together at time of Census were of same Religion.				
Religion.			such Religion Residing at	Number.	bands of such	total Wives of such Religion Residing with Husbands		
CHRISTIAN-					% 81.21	% 82.34		
Church of England		244,743	241,387	198,749	81.21			
Presbyterian		81,710	77,291	59,837	73.23	77.42		
Methodist		80,249	82,932	68,186	84.97	82.22		
Baptist		14,584	15,515	11,230	77.00	72.38		
Congregational		11,516	11,209	8,813	76.53	78.62		
Lutheran		12,585	10,297	9,099	72.30	88.37		
Church of Christ		5,376	6,232	4.573	85.06	73.38		
Salvation Army		3,678	3,932	3,159	85.89	80.34		
Seventh Day Adventist		675	927	603	89.33	65.05		
Unitarian		533	279	181	33.96	64.87		
Protestant (undefined)		17,898	15,218	12,005	67.07	78.89		
Roman Catholic		103,814	115,404	85,187	82.06	73.82		
Greek Catholic		272	161	139	51.10	86.34		
Catholic (undefined)		9,105	10,298	5,444	59.79	52.86		
Others		4,966	4,635	3,652	73.54	78.79		
NON-CHRISTIAN-	• •	_,,,,,	-,					
Hebrew		3,013	2,564	2,210	73.35	86.19		
Confucian		86	60	55	63.95	91.67		
Mohammedan		169	62	62	36.69	100.00		
Buddhist		92	66	58	71.74	87.88		
Pagan		20	5	5	25.00	100.00		
Others		263	152	102	38.78	67.11		
INDEFINITE—	• •	200	102	~-				
Freethinker		712	179	133	18.68	74.30		
Agnostic		821	220	189	23.02	85.91		
No Denomination		534	315	259	48.50	82.22		
Others		1,140	676	489	42.89	72.34		
NO RELIGION—	• •	1,140	. 010	3.33	12.55			
No Religion		1,837	502	393	21.39	78.29		
Atheist	• •	101	18	11	10.89	61.11		
Others		51	7	2	39.22	28.57		
Outors	• •		<u> </u>					
ALL RELIGIONS	•. •	600,543	600,543	474,825	79.07	79.07		

Of the 623,720 cases in which husband and wife were enumerated together, there were 23,177 in which one or both of the parties either objected or omitted to state their religious belief, leaving 600,543 cases for which full comparative data in respect of religion were available. Out of these there were 474,825 cases, or 79 per cent., in which the parties professed the same religious belief, leaving 125,718 cases, or 21 per cent., of mixed marriages. There were in all 13 cases in which the number of unmixed marriages exceeded 1000. Amongst these the proportions of males who were parties to such marriages were, in descending order, as follows: Salvation army, 85.89 per cent.; Church of Christ, 85.06 per cent.; Methodist, 84.97 per cent.; Roman Catholic, 82.06 per cent.; Church of England, 81.21 per cent.; Baptist, 77 per cent.; Congregational, 76.53 per cent.; Other Christians, 73.54 per cent.; Hebrew, 73.35 per cent.; Presbyterian, 73.23 per cent.; Lutheran, 72.30 per cent.; Protestant (undefined), 67.07 per cent.; Catholic (undefined), 59.79 per cent. In the case of females the proportions were as follows:—Lutheran, 88.37 per cent.; Hebrew, 86.19 per cent.; Church of England, 82.34 per cent.; Methodist, 82.22 per cent.; Salvation Army, 80.34 per cent.; Protestant (undefined), 78.89 per cent.; other Christians, 78.79 per cent.; Congregational, 78.62 per cent.; Presbyterian, 77.42 per cent.; Roman Catholic, 73.82 per cent.; Church of Christ, 73.38 per cent.; Baptist, 72.38 per cent.; Catholic (undefined), 52.86 per cent.

It appears probable, as already mentioned on p. 200, that the persons enumerated as "Catholic," and tabulated as "Catholic (undefined)" were in the majority of cases members of the Roman Catholic Church. Assuming that all were such members, the figures for unmixed marriages for that church would be 92,896, while the corresponding total for husbands would be 112,919, and for wives 125,702, giving a proportion for husbands who were parties to unmixed marriages of 82.27 per cent., and for wives 73.90 per cent., as against 82.06 per cent. and 73.82 per cent. deduced above.

In the succeeding table particulars are given for both husbands and wives in respect of absenteeism and religion:—

Absenteeism and Religion, Commonwealth, 1911.

					whose V	each Religion Vives were esent.	Wives of each Religion whose Husbands were Absent.		
Relie	GION.				Number.	Proportion per cent. of Husbands of each Religion.	Number.	Proportion per cent. of Wives of each Religion.	
CHRISTIAN-		_				%	-	%	
Church of England					42,233	14.66	45,503	15.62	
Presbyterian					13,243	13.89	12,803	14.03	
Methodist		• •			8,558	9.60	11,013	11.54	
Baptist					1.665	10.19	2,221	12.23	
Congregational	• •	• •	• • •	• • •	1,162	9.13	1,392	10.84	
Lutheran	• • •				1,874	12.90	1,039	9.06	
Church of Christ	• •	• • •		• •	568	9.52	938	12.64	
Salvation Army			• •	• •	496	11.81	751	15.74	
Seventh Day Adventist		• •	• •	• •	106	13.38	246	19.73	
Unitarian		• •	• •	• •	106	16.46	50	14.49	
Protestant (undefined)	• •	• •	e • •	• •	4,911	21.41	2,684	14.73	
Roman Catholic	• •	• •	• •	• •	19,766	15.93	25,051	17.52	
Greek Catholic	• •	• •	• •	• •	285	50.71	47	22.17	
Catholic (undefined)	• •	• •	• •	• •		17.35	2,464	18.88	
Others	• •	• •	• •	• •	1,927	15.66	755	13.62	
NON-CHRISTIAN—	• •	• •	• •	• •	937	15.00	100	13.02	
TT 1					01.4	10 70	501	16.23	
Hebrew	• •	• •	• •	• •	614	16.76	501 8	11.76	
Confucian	• •	• •	• •	• •	1,604	94.74			
Mohammedan	• •	•. •	• •	• •	724	80.27	15	19.48	
Buddhist	• •		• •	• •	446	81.99	24	26.37	
Pagan		• •		• •	500	95.42	.4	40.00	
Others					1,450	84.11	40	20.30	
INDEFINITE—									
Freethinker	• •				343	31.76	58	23.87	
Agnostic					281	24.37	-32	12.60	
No Denomination					116	17.44	46	12.23	
Others					357	23.14	171	19.79	
NO RELIGION—					1				
No Religion					879	31.19	103	15.92	
Atheist					69	37.91	8	27.59	
Others					19	24.05	2	22.22	
Object to State					3,767	18.26	1,473	13.68	
Unspecified	• •				3,123	50.63	611	21.58	
ALL RELIGIONS			,		112,129	15.24	110,053	15.00	

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In the case of husbands the lowest proportions of absenteeism were amongst members of the Congregational Church, 9.13 per cent.; the Church of Christ, 9.52 per cent.; and the Methodist Church, 9.60 per cent.; while the highest proportions were amongst "Pagans," 95.42 per cent.; Confucians, 94.74 per cent.; Buddhists, 81.99 per cent.; and Mohammedans, 80.27 per cent.

In the case of wives the lowest proportions of absenteeism were amongst the members of the Lutheran Church, 9.06 per cent.; the Congregational Church, 10.84 per cent.; and the Methodist Church, 11.54 per cent.; whilst the highest proportions amongst those denominations represented by as many as 200 absentees were found in the cases of Seventh Day Adventists, 19.73 per cent.; Catholic (undefined), 18.88 per cent.; and Roman Catholic, 17.52 per cent.

5. **Issue of Husbands.**—As a demographic item expressive of the power of reproduction under given circumstances, statistics relative to issue, whether of husbands or wives, must always be studied in relation to age, and this has been very fully done both in the later sections of the present chapter, and in very great detail in Volume III. of this Report. The frequency statistics of total issue, irrespective of age, are, however, of considerable importance and interest, and those in respect of husbands are as follows for the several States and Territories, as well as for the Commonwealth as a whole:—

Issue	οf	Husbands,	1911.
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				)		S	TATES.			TERRIT	ORIES.	
	Тотаі	. Issue	c.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
					NUM	BER OI	HUSBA	NDS.	<u> </u>	• • • • • • • • • • • • • • • • • • • •		1
				34,782	26,825	11,474	8,457	7,453	3,587	105	33	92,716
	í	• • •		40,245	29,191	13,380	9,755	7,908	4,191	134	23	104,827
	2	• • •	•	39,250	30,038	13,183	9,470	8,017	4,201	139	28	104,326
	3	• • •		32,556	26,234	11,103	8,065	6,698	3,751	63	34	88,504
	 L	• • •		26,971	21,637	9,550	6,687	5,431	3,211	41	23	73,551
	· · · · · · · · · · · · · · · · · · ·	• • • • • • • • • • • • • • • • • • • •		21,499	17,343	7,931	5,380	3,768	2,528	28	31	58,508
		• • •		17,410	13,750	6,659	4,554	2,824	2,180	20	18	47,415
	o 7	• • •	• •	14,128	11,003	5,346	3,769		1,707	6	$\frac{10}{27}$	38,006
			••	11,531	8,883	4,557		2,020	1,362	7.	20	31,121
		• •	• •	9,094	7,019	3,633	$\frac{3,214}{2,589}$	$\substack{1,547\\1,125}$	1,302	2	13	24,721
		• •	• •	7,443						$\frac{2}{2}$	12	19,769
$\frac{10}{11}$		• •	• •	5,069	5,517 3,681	2,869	2,102	854	970	3	4	13,168
	-	• •	• •			1,846	1,345	536	684	3 1	3	
13		• •	• •	$\frac{3,473}{2,037}$	2,610	1,267	1,018	414	524	$egin{array}{c} 1 \\ 2 \end{array}$	3	$\begin{array}{c} 9,310 \\ 5,452 \end{array}$
		• •	• •	2,037	1,530	760	610	205	305	1	3 1	
14			• •	1,093	841	380	354	108	192	1	_	2,970
13		• •	• •	630	395	208	165	50	109	• •	• •	1,557
10		• •	• •	333	231	118	89	28	` 66	• •	• •	865
1'		• •	• •	134	107	- 56	44	15	29	• •	• •	385
18		• •	• •	78	67	25	24	11	12	• • `	• •	217
19		• •	• •	43	37	16	13	5	5	• •	• •	119
20			• •	21	19	6	5	2	7	. • •	• •	60
	lando		• •	42	30	10	9	8	11		• • •	110
U	nspecifi	ed	• •	7,566	4,762	2,169	1,384	1,675	592	21	3	18,172
	Тотлі	L	• •	275,428	211,750	96,546	69,102	50,702	31,470	575	276	735,849
		_		PRO	PORTION	PER C	ENT. OF	ALL IS	SUES			
							%			0/ 1	0/	0/
	J			% 12.98	12.96	$\begin{array}{c} \%\\12.16\end{array}$	12.49	$^{\%}_{15.20}$	$^{\%}_{11.62}$	% 18.95	$^{\%}_{12.09}$	% 12.92
	, l		• •	15.02	14.10	14.18	$12.43 \\ 14.41$	16.13	13.57	$\frac{16.35}{24.19}$	8.42	14.61
	2		• •	14.65	14.51	13.97	13.98	16.35	13.60	25.09	10.26	14.54
	3	• • •		12.15	12.68	11.76	11.91	13.66	12.15	11.37	12.45	12.33
				10.07	10.45	10.12	9.88	11.08	10.40	7.40	8.42	10.25
	1 5	• •	• •	8.03	8.38	8.40	$\frac{9.00}{7.94}$	7.69	8.19	5.06	11.35	8.15
	6		• • •	6.50	6.64	7.06	6.73	5.76	7.06	3.61	6.59	6.61
	7			5.27	5.32	5.66	5.57	$\begin{array}{c} 3.70 \\ 4.12 \end{array}$	5.53	1.08	9.89	5.29
	3	• •	• •	4.30	4.29	4.83	4.75	3.16	4.41	1.27	7.33	4.34
	_			3.40	3.39	3.85	3.82	$\begin{array}{c} 3.10 \\ 2.29 \end{array}$	4.04	.36	4.76	3.44
10		• •	• •	2.78	2.67	3.04	3.10	$\begin{array}{c} 2.29 \\ 1.74 \end{array}$	3.14	.36	4.40	2.75
1	-	• •	• •	1.89	1.78	1.96	1.99	1.09	$\frac{3.14}{2.21}$	.54	1.47	1.83
1:	-	• •		1.30	1.76	1.34	1.50	.84	1.70	.18	1.10	1.30
1:		• •	• •	.76	.74	.80	.90	.42	.99	.36	1.10	.76
1.		• •		.41	.41	.40	.52	.22	.62	.18	.37	.41
1	_	• •	• •	.24	.19	.22	.24	.10	.35			.22
1		• •	• •	.12	.11	.12	.13	.10	.33			.12
1		• •	• • •	.05	.05	.06	.06	.03	.09	::		.05
1:		• •		.03	.03	.03	.04	.02	.04		• • •	.03
1		• • •		.03	.02	.02	.02	.01	.02		• •	.02
2		• •	• • •	.01	.01	.01	.01	.01	.02			.01
	lando	ver	• •	.02	.01	.01	.01	.02	.04			.02
_			• •				1					ļ
	TOTA	L	• •	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
					1	1	1	1	1	1	i	1

In the case of the Territories the smallness of the figures and the special nature of the circumstances necessarily led to some irregularity in the proportions shewn in the above table. Amongst the States, however, there is marked regularity in the proportions corresponding to the successive total issues. The proportions for any given issue do not, in the case of the States, vary very largely from the corresponding proportion for the Commonwealth, the most marked deviations being in the case of Western Australia, which has a preponderance of instances of issues of 0, 1, 2, 3 and 4 children, and a shortage of issues of 5 and upwards, and in Tasmania, which has a preponderance of issues of 9 and upwards, and exhibits the lowest proportions of any of the States for issues of 0, 1, and 2. It would thus appear that amongst the States, large families are proportionately most numerous in Tasmania, and least numerous in Western Australia. This fact, in respect of Western Australia, is in part, though not entirely, due to the lower average age of the husbands, as may be seen by reference to the table on p. 266.

The proportions of husbands who had issue of less than 5 were as follows:—Western Australia, 72.42 per cent.; New South Wales, 64.87 per cent.; Victoria, 64.70 per cent.; South Australia, 62.67 per cent.; Queensland, 62.19 per cent.; and Tasmania, 61.34 per cent. On the other hand, the proportions of husbands who had issue of 10 or more were as follows:—Tasmania, 9.43 per cent.; South Australia, 8.52 per cent.; Queensland, 8.01 per cent.; New South Wales, 7.63 per cent.; Victoria, 7.28 per cent.; and Western Australia, 4.56 per cent.

For the Commonwealth as a whole the proportion of husbands who had issue of less than 5 was 64.65 per cent., while the proportion having issue of 10 or upwards was 7.52 per cent.

The figures in the foregoing table relate to total issue of the husbands, and consequently, in the case of husbands who have been married more than once, they include the children of all the marriages. It must also be noted that the issue figures dealt with at the Census were not restricted to relate to issue living at the date of the Census, but comprise all children born alive, whether they had survived or not.

6. Issue of Wives.—In the next table are given, according to the States and Territories of enumeration, the number and proportion of wives for each degree of total issue. As in the case of husbands in section 5, the figures relate to total issue, and not merely to the issue of the marriage in existence at the date of the Census.

Tesma	of	Wives,	1911.
122 mg	OI	AA TA CO	4044.

		•	ST	ATES.			TERRI	rories.	
Total Issue.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'weth

## NUMBER OF WIVES.

					1			1				
0				33,277	26,879	10,448	8,478	6,302	3,610	46	24	89,064
1				40,742	30,231	12,825	9,894	7,000	4,274	37	16	105,019
2				39,676	30,865	12,645	9,610	7,133	4,268	30	26	104,253
3				33,102	26,872	11,047	8,243	6,139	3,792	28	33	89,256
4				27,333	22,142	9,490	6,756	5,048	3,233	20	22	74,044
4 5				21,810	17,758	7,949	5,391	3,493	2,533	17	25	58,976
6				17,740	14,116	6,768	4,549	2,719	2,189	11	11	48,103
7				14,424	11,323	5,427	3,784	1,934	1,674	5	23	38,594
8				11,754	9,066	4,669	3,184	1,506	1,366	2	18	31,565
9				9,484	7,276	3,669	2,580	1,118	1,221	1	13	25,362
10				7,677	5,706	2,942	2,073	843	975	1	12	20,229
11				5,253	3,803	1,870	1,331	522	692	3	4	13,478
12				3,567	2,623	1,252	952	395	538	1	1	9,329
13				2,068	1,475	737	570	206	300	1	1	5,358
14				1,007	764	366	322	99	183	1	1	2,743
15				550	352	187	139	56	96	[		1,380
16				276	164	94	65	22	53			674
17				102	70	42	23	11	23			271
18				51	33	17	13	6	10			130
19				25	7	9	5	3				49
20				12	8	1	2	1	3	[		27
21	and ov	er		20	13	6	3	3	4			49
Uns	specifie	d	• •	6,266	4,919	1,454	1,418	1,221	536	3	3	15,820
	Total		••	276,216	216,465	93,914	69,385	45,780	31,573	207	233	733,773

FAMILIES.

Issue of Wives, 1911-continued.

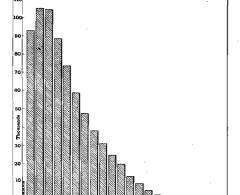
					STAT	res.			TERRIT	TORIES.	
TOTAL	Issue	•	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlti
			PROI	PORTION	PER CE	ENT. OF	ALL ISS	UES.	,		
_			%	%	%	%	%	%	%	%	%
0		• •	12.33	12.70	11.30	12.47	14.14	11.63	22.55	10.44	12.40
1	• •	• •	15.09	14.29	13.87	14.56	15.71	13.77	18.14	6.96	14.63
2		• •	14.70	14.59	13.68	14.14	16.01	13.75	14.71	11.30	14.52
3		• •	12.26	12.70	11.95	12.13	13.78	12.22	13.73	14.35	12.43
4		• •	10.13	10.47	10.26	9.94	11.33	10.42	9.80	9.57	10.31
5	• •	• •	8.08	8.39	8.60	7.93	7.84	8.16	8.33	10.87	8.21
6		• • •	6.57	6.67	7.32	6.69	6.10	7.05	5.39	4.78	6.70
7			5.34	5.35	5.87	5.57	4.34	5.40	2.45	10.00	5.38
8			4.35	4.29	5.05	4.69	3.38	4.40	.98	7.83	4.40
9			3.51	3.44	3.97	3.80	2.51	3.94	.49	5.65	3.53
0			2.84	2.70	3.18	3.05	1.89	3.14	.49	5.22	2.82
1			1.95	1.80	2.02	1.96	1.17	2.23	1.47	1.74	1.88
2			1.32	1.24	1.35	1.40	.89	1.73	.49	.43	1.30
3			.77	.70	.80	.84	.46	.97	.49	.43	.75
4			.37	.36	.39	.47	.22	.59	.49	.43	.38
5			.20	.17	.20	.20	.13	.31		'	.19
6			.10	.08	.10	.10	.05	.17	• • •		.09
7			.04	.03	.05	.03	.02	.07			.04
8	• •		.02	.02	.02	.02	.01	.03			.02
9			.01		.01	.01	.01				.01
0			.01					.01			
l and ov	er	••	.01	.01	.01	• •	.01	.01	••	••	.01
TOTAL			100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

As in the case of husbands in section 5, the Western Australian proportions for issues under 5 are higher than for any other State, and those for issues of 5 and upwards are lower than for any other State. The records for low proportions for issues under 5 and for high proportions for issues of 5 and upwards are shared between Tasmania and Queensland.

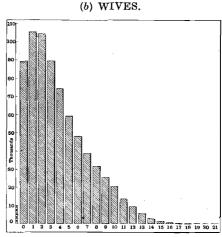
The proportions of wives who had issue of less than 5, were as follows:—Western Australia, 70.97 per cent.; Victoria, 64.75 per cent.; New South Wales, 64.51 per cent.; South Australia, 63.24 per cent.; Tasmania, 61.79 per cent.; and Queensland, 61.06 per cent. The similar proportions for those who had issue of 10 or more were as follows:—Tasmania, 9.26 per cent.; Queensland, 8.13 per cent.; South Australia, 8.08 per cent.; New South Wales, 7.64 per cent.; Victoria, 7.11 per cent.; and Western Australia, 4.86 per cent.

For the Commonwealth as a whole the proportion of wives who had issue of less than 5 was 64.29 per cent., while the proportion having issue of 10 or upwards was 7.49 per cent.

Total Issue of Husbands and Wives, Commonwealth, 1911.
(a) HUSBANDS.
(b) WI



GRAPH No. 100.



GRAPH No. 101.

The accompanying graphs (Nos. 100 and 101) represent the numbers of cases in which the husbands and wives respectively had had, as issue, children to the number indicated on the base line. The numbers represented relate to total issue in each case, and not merely to the issue of the marriage in existence at the date of the Census. They also relate to total number born alive irrespective of whether they had survived to the date of the Census or not.

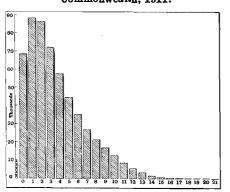
7. Birthplace and Issue of Wives.—The succeeding table furnishes for a summarised classification of birthplaces, the number and proportion of wives for each degree of total issue. It will be seen that Australia and the United Kingdom as birthplaces account for more than 95½ per cent. of the wives:—

Birthplaces and Issue of Wives, Commonwealth, 1911.

_	<b></b>					Wives	Born	IN				Birth- place	All
7	Fotal Is	sue.	Aus- tralia.	New Zea- land.	United King- dom.	Rest of Europe.	Asia.	Africa.	Amer- ica.	Poly- nesia.	At Sea.	Un- speci- fied.	Birth- places.
			<u> </u>			NUMBE	ROF	VIVES.					
0			68,242	1,300	16,666	1,232	266	119	341	47	120	731	89,06
ì			87,969	1,411	13,156	1,027	215	125	248	62	108		105,01
2			85,907	1,340	14,440	1,093	203	141	238	56	122	713	
3			71,719	1,060	14,096	1,099	207	106	211	36	124	598	89,25
4			57,463	776		1,108	208	72	182	33	97	568	74,04
5	• •		44,188	534		1,046	189	75	132	34	81	455	58,97
6	• •		34,557	423		1,071	125	35	108	19	109	392	48,10
7	• •	• •	26,643	264		905	128	31	92	17	93	295	38,59
8	• •	• •	21,119	171	8,837	876	78	30	82	8	85	279	31,56
9 10	• •	• •	16,512	142	$7,456 \\ 6,593$	802	47	$\frac{25}{17}$	63	5	77 66	233	25,36
1	• •	• •	12,569 8,454	$\begin{array}{c} 95 \\ 42 \end{array}$	$\frac{0,393}{4,282}$	$\begin{array}{c} 639 \\ 456 \end{array}$	38 30	17 11	36 49	8	$\begin{array}{c} 66 \\ 47 \end{array}$	$\frac{168}{104}$	20,22 $13,47$
2	• •		5,670	33	3,110	352	13	6	21	9	36	86	9,32
13	• • •		3,225	23	1,813	197	13	5		$\frac{2}{2}$	22	45	5,36
14			1,647	9			7	$\stackrel{\circ}{1}$	4	ī	17	26	2,74
15			820	. 5	463	64	2	2	3		9	12	1,38
6			392	1	230	35	3	1	2	1	3	6	6
۱7			159	3	96	6						7	2'
l8			67	1	51	9			1			1	13
19			24	• •	25						••		4
20	· •		13	1.	10	2	1	• •	••		• •	• • •	1
	and ove	r	10,873	$\begin{array}{c} 1\\198\end{array}$	20 3,553	$\begin{array}{c} 3 \\ 296 \end{array}$	- 1 58	31	76	21	17	$\begin{array}{c} 2 \\ 697 \end{array}$	
	TOTAL		558,254		142,981	12,431	1,832		1,902		1,233	6,116	733,77
			!	-	P	ROPOR'	TION E	ER CE	NT.				
					<u> </u>				1				
0			% 12.47	% 17.03	% 11.95	%,	.%	% 14.78	% 18.68	% 14.07	%	% 12.40	% 12.4
0	• •	• •			11.95	10.15	14.99		18.68	14.07	9.87	13.49 $12.88$	12.4
$_{2}^{1}$	• •	• •	$\begin{array}{c c} 16.07 \\ 15.69 \end{array}$	18.48 $17.55$			12.12 $11.44$		13.58 13.03	$18.56 \\ 16.77$	$8.88 \\ 10.03$	13.16	
3	• • •	• •	13.10			9.06	11.67				10.20	11.03	
4	• • •	• •	10.50	10.16		9.13	11.73			9.88	7.98	10.48	10.
5	• •		8.07	7.00			10.65			10.18	6.66	8.40	8.5
6			6.31	5.54			7.05				8.96	7.23	
7			4.87				7.22				7.65	5.44	5.
8			3.86				4.40				6.99	5.15	
9	• •		3.02				2.65				6.33	4.30	
10	• •	٠.	2.30				2.14				5.43	3.10	
11	• •	• •	1.55				1.69				3.86		
12	• •	• •	1.04				.73				2.96		
13	• •	• •	.59				.73				1.81	.83	
l4 l5	<b></b>	• •	.30				.39				$1.40 \\ .74$		
16	• •	• •	.07				.17				.25	.11	
17		• •	.03									.13	
18	• • •		.01	.01				::	.05		• • •	.02	
19		• • •			.02						• •		
20				.01			.06						
	and ove			.01			.06				••	.04	
	TOTAL		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.

As between Australia and the United Kingdom as birthplaces, there is a marked excess in the case of Australia in the proportion of cases of total issue below 5, and an equally marked

Total Issue of Australian-born Wives. Commonwealth, 1911.



GRAPH No. 102,

deficit in the proportion of cases of total issue of 5 and upwards. In fact, no less than 67.83 per cent. of the Australian-born wives had a total issue of less than 5, as compared with only 51.56 per cent. of the wives born in the United Kingdom who had a smaller total issue than 5. As will be shewn later, however (see p. 282 hereinafter) this result is entirely due to difference in age distribution, and when the data are classified according to age, the Australian-born women exhibit higher average issues at practically all ages than those born in the United Kingdom.

Graph No. 102 furnishes in respect of Australian born wives the same information as was furnished in Graph No. 101 in respect of wives of all birthplaces. As before, the figures on the base line indicate the total live born issue from all marriages, irrespective of whether the children so born were living or dead

at the date of the Census.

FAMILIES. 277

8. Religion and Issue of Wives.—In the next table are given for each degree of total issue the number and proportion of wives for the principal religions and denominations:—

# Religion and Issue of Wives, Commonwealth, 1911.

				1 7	WIVE	s whose	RELIGIO	n or De	NOMINAT	ION WAȘ	_				
Total Issue	Church of England.	Presbyterian.	Methodist.	Baptist.	Con- gregational.	Lutheran.	Church of Christ.	Salvation Army.	Protestant (undefined).	Roman Catholic.	Catholic (undefined).	Other Christians.	Hebrew.	Others(incl'd- ing Object to State and Unspecified.)	All Religion

### NUMBER OF WIVES.

0	35,718	11,498	10,220	2,205	1,522	1.086	873	508	2,464	17,540	1,623	944	443	2,420	89,064
1	44,128	13,195	12.929	2,482	1,793	1,256	1,073	555	2,826	18,792	1,940	904	500	2,646	
2	43,497	13,220	13,347	2,554	1.996	1,275	1,048	561	2,638	18,404	1,765	910	505	2,533	
3	36,224	11,499	11,971	2,260	1.729	1,176	916	554	2,157	15,965	1,632	856	401	1,916	89,256
4	28,964	9,491	10,136	1,927	1,345	1,103	730	468	1.819	14,100	1,286	773	327	1,575	74,044
5	22,746	7,383	8,075	1,530	1,085	970	632	395	1,314	11,796	1,031	609	212	1.198	58,976
6	17,819	5,957	6,670	1,206	910	891	508	361	1,094	10,150	849	534	186	968	48,103
7	14,436	4,652	5,188	1,018	659	741	368	292	839	8,442	690	431	136	702	38.594
8	11,587	3,831	4.375	776	529	720	324	$\frac{260}{260}$	733	6,924	516	357	84	549	31,565
9	9,263	2,964	3.561	600	399	630	252	221	593	5,651	441	285	75	427	25,362
10	7,622	2,282	2.887	500	291	496	199	181	456	4,359	331	223	53	349	20,229
11	5,096	1,570	1,847	302	175	325	159	134	287	2,959	199	162	28	235	13,478
12	3,565	936	1,300	253	127	292	108	93	226	1,981	141	124	23	160	9.329
13	2,109	541	760	134	63	150	46	59	121	1,135	<b>2</b> 90	58	10	82	5,358
14	1,069	254	403	69	34	85	27	26	75	568	₹57	33	3	40	2.743
15	549	125	181	27	19	45	īš	$\overline{12}$	39	295	22	21	5	27	1,380
16	260	67	94	13	11	21	5	-9	16	136	<b>-</b> 17	6	6	27 13	674
17	116	25	34	6	3	3	ĭl	3	5	58	7	4	2	4	271
18	50	12	18	2	3	5	7	ž	5	22		4	3	4	130
19	22	4	8	3		1			ī	9	1	🦻	1		49
20	7		2	1		1	- ::		īl	11	ï	2	"	1	27
21 &	1		_	_		-			-1		_				e40.74
over	22	3	4				!		1	16			1	2	49
Not		1		1					-				- 1		
stat'd	6,358	1,760	1,455	285	151	195	136	77	510	3,676	414	108	83	612	15,820
Total	291,227	<b>91,26</b> 9	95,465	18,153	12,844	11,466	7,418	4,771	18,220	142,989	13,053	7,348	3,087	16,463	733,77 <b>8</b>

## PROPORTION PER CENT. OF ALL ISSUES.

1	%	%	%	%	% :	%	%	% :	%	%	%	1 %	%	%	%
0	12.54	12.85	10.87	12.34	11.99	9.64	11.99	10.82	13.91	12.59	12,84	13,04	14,75	15.27	12.40
ĭ	15.49	14.74	13.75	13.89	14.13	11.14	14.74	11.82	15.96	13.49	15.35	12.49	16.64	16.69	14.68
2	15,27	14.77	14.20	14.29	15.72	11.31	14.39	11,95	14.89	13.21	13.96			15.98	14.52
3	12.72	12.85	12.73	12.65	13.62	10.43	12.58	11.80	12.18	11.46	12.91			12.09	12.43
4	10.17	10.60	10.78	10.78	10.60	9.79	10.03	9.97	10.27	10.12	10.18		10.88	9.93	10.31
5	7.98	8,25	8.59	8.56	8.55	8.61	8.68	8.42	7.42	8.47	8.16	8.41	7.06	7.56	8.21
6	6.25	6.65	7.10	6.75	7.17	7.91	6.98	7.69	6.18	7.28	6.72	7.37	6.19	6.11	6.70
7	5.07	5.20	5.52	5.70	5.19	6.57	5.05	6.22	4.74	6.06	5.46		4.53	4.43	5.38
. 8	4.07	4.28	4.65	4.34	4.17	6,39	4.45	5.54	4.14	4.97	4.08			3.46	4.40
9	3.25	3.31	3.79	3,36	3.14	5.59	3.46	4.71	3.35	4.06	3.49	3.94	- 2.50	2.69	3.53
10	2.68	2.55	3.07	2.80	2.29	4.40	2.73	3.86	2.57	3.13	2.62	3.08	1.76	2.20	2.82
11 12	1.79	1.75	1.97	1.69	1.38	2.88	2.18	2.86	1.62	2.12	1.57		.93	1.48	1.88
13	1.25	1.05	1.38	1.42	1.00	2,59	1.48	1.98	1.27	1.42	1.12		.77	1.01	1.30
14	.74 .37	.60 .28	.81 .43	.75 .39	.50	1.33 .75	. <b>63</b> .37	1.26	.68	.81 .41	.71 .45	.80 .46	.33	.52 .25	.75 .38
15	.19	.14	.19	.15	.27 .15	.40	.18	.55 .26	$.42 \\ .22$	.21	.17	.29	.10 ,17	.17	.19
16	.09	.08	.10	.07	.09	.19	.07	.19	.09	.10	.13		.20	.08	.09
17	.04	.03	.04	.03	.02	.03	.01	.06	.03	.04	.06		.07	.03	.04
18	.02	.01	.02	.01	.02	,04	.01	.04	.03	.02		.06	.10	.03	.02
19	.ŏī	.01	.01	.02					.01	.01	.01		.03		.01
20				.01		.01	- ::		.01	,01	.01	.02		.01	
21 &				••-			• • •			••-	•			•	
over	.01	••	••	••.					.01	.01			.03	.01	.01
Total	100.00	100,00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
								,							

A feature of this table is the large proportion of Lutheran wives having a total issue of 5 and upwards, and the small proportion of Hebrew wives having such a total. Thus, while no less than 47.69 per cent. of the Lutheran wives had a total issue of 5 and upwards, only 27.57 per cent. of the Hebrew wives were so represented. The same relative positions are also disclosed when the data are analysed according to age. Of the four denominations most largely represented, the Roman Catholic wives, with 39.13 per cent., furnished the largest proportion of cases of total issue of 5 or upwards. The corresponding proportion for Methodist wives was 37.67 per cent., for Presbyterian wives 34.19 per cent., and for Church of England wives 33.81 per cent.

<sup>9.</sup> Duration of Marriage and Issue of Wives.—Particulars concerning the number and proportion of wives of each degree of total issue of existing marriage are furnished in the following table, classified according to the duration of such marriage:—

# Duration of Marriage and Issue of Wives, Commonwealth, 1911.

Total Issue of Existing Marriage		Wives whose Duration of Existing Marriage was—													
Existing Marriage	Under 5 years.	5-9 years.	10-14 years.	15-19 years.	20-24 years.	25-29 years.	30-34 years.	35–39 years.		45 years & over.	Not speci- fied.	Dura- tions.			

### NUMBER OF WIVES.

0		51,446	16,413	11,230	6,729	5,183	3,574	2,074	1,338	743	681	2,513	101,92
i		57,692	20,016		6,214	4,560	2,686	1,438	855	424	412	2,309	
2		26,444	35.042		9,234	6,830	3,834	1,879	1,009	548	426	2,531	103,86
3		4,088	32,787		10,806	8,839	5,404	2,504	1,347	666	575	2,349	88,33
4		325	16,963		11,311	9,729	6,584	3,279	1,817	845	764	2,132	
4 5		16	5.393		10,107	9,239	7,017	3,889	2,143	1.103	1,052	1,925	57,43
6			1,225		9,064	8,377	7,012	4,155	2,414	1,408	1,306	1,643	
7			237	4,369	7,054	7,106		4,397	2,677	1,618	1,644	1,367	36,82
8			60	1,561	4,706	5,765	5,565	4,309	3,010	1,740	1,975	1,166	29,85
9			5	494	2,598	4,559		3,963	2,831	1,811	2,109	967	23,93
.ŏ			ĭ	120	1,199	3,124	3,568	3,345	2,566	1,848	2,389	787	18,94
ĭ	• • •	ì		43	499	1,627	2,379	2,283	1,919	1,432	1,840	543	12,56
$\hat{2}$				7	189	883		1,518	1,508	1,066	1,580	443	8.65
3				4	67	413	817	887	842	667	975	259	4,93
4				1	20	172	407	460	462	354	541	112	2,52
5	• • •				-ĕ	79	194	218	219	198	289	56	1,2
6	• • •				ĭ	27	109	101	119	98	140	22	6
7	•			::	1	7	34	45	45	40	59	15	24
8					•••	4	12	20	20	16	30	5	10
9	• • •			::	••	*	2	4	16	3	16	$\tilde{2}$	4
ŏ	• • •		• • •		::		4	3	6	ĭ	ĩ	ī	ĺ
	over			••		1	4	4	9	6	14	4	4
Tot	0 101	•••	• • •	• • •	••	••	-	-	<b>"</b>	J		-	_
	ted	3,018	2,609	1,864	1,232	1,087	847	531	394	207	284	3,747	15,82
To	TAL	143,029	130,751	109,164	81,036	77,611	62,468	41,306	27,566	16,842	19,102	24,898	733,77

# PROPORTION PER CENT. OF ALL ISSUES.

										21		07	
_		%	%	%	%	%	%	%	%	%	%	%	<b>%</b>
0	• •	36.74	12.81	10.47	8.43	6.77	5.80	5.09	4.92	4.46	3.62	11.88	14.20
1		41.21	15.62	9.87	7.79	5.96	4.36	3.53	3.15	2.55	2.19	10.92	14.93
2		18.89	27.35	15.00	11.57	8.93	6.22	4.61	3.71	_3.29	2.26	11.97	14.47
3		2.92	25.59	17.68	13.54	11.55	8.77	6.14	4.96	4.00	3.06	11.11	12.30
4		.23	13.24	17.47	14.17	12.71	10.68	8.04	6.69	5.08	4.06	10.08	10.10
4 5		.01	4.21	14.49	12.66	12.07	11.39	9.54	7.89	6.63	5.59	9.10	8.00
6			.95	8:88	11.36	10.95	11.38	10.19	8.88	8.46	6.94	7.77	6.42
7			.18	4.07	8.84	9.29	10.31	10.78	9.85	9.72	8.74	6.46	5.13
8			.05	1.45	5.90	7.53	9.03	10.57	11.08	10.46	10.49	5.51	4.16
ğ				.46	3.26	5.96	7.46	9.72	10.42	10.89	11.21	4.57	3.33
10				.11	1,50	4.08	5.79	8.20	9.44	11.11	12.69	3.72	2.64
iĭ				.04	.63	2.13	3.86	5.60	7.06	8.61	9.78	2.57	1.75
12	• •			.01	.24	1.15	2.38	3.72	5.55	6.41	8.40	2.09	1.21
13	• •	• • •	•••	1	.08	.54	1.33	2.17	3.10	4.01	5.18	1.23	.69
14	• • •	••	•••	•••	.02	.22	.66	1.13	1.70	2.13	2.87	.53	.35
15	• •	• •	••	•••	.02		.31	.53	.81	$\frac{2.13}{1.19}$	1.54	.27	.17
	• •	• •	••	•••	.01	.10					.74		
16	• •	• •	• •	• •	• •	.04	.18	.25	.44	.59		.10	.09
17	• •	• •	• •	••	• •	.01	.05	.11	.17	.24	.31	.07	.03
18	• •	• •	• •	• •	• •	.01	.02	.05	.07	.10	.16	.02	.01
19	• •	• •	• •	• •	• •	• •	• •	.01	.06	.02	.09	.01	.01
20							.01	.01	.02	.01	.01	• •	
21 &	over					• • [	.01	.01	.03	.04	.07	.02	.01
	- 1												
To	TAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		Į				ļ		Į					

As the figures contained in this table relate solely to the issue of existing marriages, they necessarily represent a smaller aggregate issue than is represented by those contained in earlier tables in this chapter. An interesting feature of this table is the varying position of the point of maximum frequency in the different periods of duration. Thus for duration "under 5 years" it is at issue 1; for 5-9, at 2; for 10-14, at 3; for 15-19 and for 20-24, at 4; for 25-29, at 5; for 30-34, at 7; for 35-39, at 8; for 40-44, and also for 45 and over, at 10. There were in all 17 cases of a total issue of 20 for a single marriage, and no fewer than 41 cases of issue of 21 or over.

It may be noted that more than 50 per cent. of the cases in which there was no issue, were marriages of less than 5 years' duration, and that amongst the marriages of 15 years' duration and upwards in only  $6\frac{1}{3}$  per cent. of the cases was there no issue, while in marriages having a duration of 45 years or over the proportion of cases of no issue was less than  $3\frac{2}{3}$  per cent.

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10. Age and Average Issue.—In the following table are given the average issues of husbands of various ages enumerated in the several States and Territories of the Commonwealth at the Census of 1911:—

Age and Average Issue of Husbands, 1911.	Age	and	Average	Issue	οf	Husbands.	1911.
------------------------------------------	-----	-----	---------	-------	----	-----------	-------

					ST	ATES.			TERE	ITORIES.	
Ages of	Husba	ands.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
Under 14				••							
14	• •		.00	.00		••					.00
15			.00		.00	.33		.00			.13
16			.56	.25	.17	.00	.00	.00			.28
17			.48	.33	.75	.33	.13	.20			.39
18			.52	.60	.62	.50	.36	.38			.53
19			.61	.60	.50	.60	.30	.75	.00		.59
20			.70	.72	.77	.66	.69	.89			.72
21-24			.96	.94	.91	.90	.85	1.03	.63	2.00	.94
25-29			1.50	1.44	1.44	1.39	1.40	1.69	.90	1.29	1.47
30-34			2.24	2.15	2.26	2.16	2.09	2.53	1.64	2.16	2.21
35-39			3.05	2.87	3.21	3.08	2.80	3.28	1.75	3.41	3.01
40-44			3.85	3.67	4.13	3.88	3.45	4.13	2.39	3.93	3.81
45-49			4.66	4.43	5.00	4.75	4.02	5.02	2.62	5.08	4.61
50-54			5.34	5.09	5.66	5.60	4.64	5.83	2.08	6.42	5.30
55-59			6.03	5.73	6.21	6.32	5.33	6.43	2.42	6.55	5.98
60-64			6.55	6.41	6.54	6.77	6.10	6.49	3.04	4.50	6.50
65-69			7.14	6.73	6.84	7.08	6.67	6.99	3.50	7.13	6.95
70-74	٠.		7.27	6.99	7.11	7.31	7.14	7 61	3.10	7.00	7.16
75-79			7.65	7.16	7.03	7.68	7.60	7.71	1.50	5.50	7.39
80-84			7.69	7.42	7.06	8.14	7.70	7.35	6.00	12.00	7.55
8589			7.65	7.21	6.82	7.89	9.65	7.60		4.00	7.45
90 and		• •	8.02	6.83	8.17	7.39	6.60	8.20	••		7.38
ALL A	GES		3.90	3.90	4.07	4.07	3.34	4.23	2.25	4.60	3.91

In this and succeeding tables relating to average issue, the expression .00 is used in cases where there were husbands or wives in a particular category, but no issue. Where blanks occur there were no husbands or wives. As indicated in section 5 above, age particulars are requisite for any complete study of the question of issues. A good example of this necessity is furnished by the above table, in which the average issue per husband is, for all ages combined, the same for New South Wales as for Victoria, viz., 3.90. When, however, the averages for successive age-groups are taken, it is seen that, with the unimportant exceptions of ages 18 and 20, the averages in the case of New South Wales are throughout markedly higher than in the case of Victoria. Similarly, it will be seen on comparing the particulars for New South Wales and the Commonwealth as a whole, that although the averages for New South Wales slightly exceed those for the Commonwealth at all points except at the unimportant ages of 15, 18 and 20, the Commonwealth average for all ages, viz., 3.91, is slightly higher than that for New South Wales. These apparent anomalies are entirely due to the different age distribution of the several populations. An increase in the proportion of husbands at advanced ages has the effect of increasing the average for all ages combined, while an increase in the proportion at the younger ages has the opposite effect.

The variation of average issue with age is very regular in all the States, and the average issue for any age varies within fairly narrow limits amongst the several States. Thus, in the case of the age-group 30-34, there is a minimum of 2.09 in Western Australia, a maximum of 2.53 in Tasmania, and a Commonwealth average of 2.21. Similarly, for age-group 75-79, there is a minimum of 7.03 in Queensland, a maximum of 7.71 in Tasmania, and a Commonwealth average of 7.39.

Above age 75 the averages fluctuate somewhat, and in the case of the Commonwealth as a whole suggest a maximum for the group 80-84. The numbers involved above age 75 are, however, so small, and the variations are relatively so slight, that the utmost that can be said with certainty is that for age 75 and upwards the total issue is approximately constant. This suggests an age slightly above 75, say 77, as the point of senile sterility. Such a conclusion is, however, not entirely warranted by the facts, since a continued diminution, during a series of years, in the average issue of males who had reached the limits of fertility would produce a series progressing with age without furnishing any indication of the point at which such limits were attained. Further, if there existed a tendency for the more fertile husbands to enjoy a longer life than the less fertile, the same result of an average issue increasing with age would be produced. On the other hand, if there were a tendency for the less fertile to be the longer lived, the effect produced would be a diminution with age after a certain point. The full significance of this comment will be more readily seen by a reference to the next table, which gives the average issue of wives of various ages enumerated in the several States and Territories of the Commonwealth at the Census of 1911:—

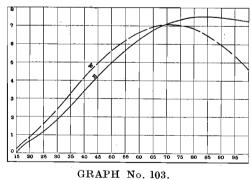
A	3	A	<b>-</b>	. 0	***	1011	
Age	and	Average	Issue	ΟÏ	Wives.	1911.	

					STA	ATES.			Terr	ITORIES.	
AGES O	WIVE	s.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
Jnder 14					.00						.00
14			.17	.33	.67	.00		.00			.28
15			.29	.25	.11	.00	1.00	.80			.27
16			.46	.43	.51	.61	.81	.60	.00		.50
17			.64	.50	.55	.49	.58	.63	.00		.58
18			.68	.69	.66	.68	.72	.75	1.67	l	.68
19			.80	.84	.84	.79	.82	.90	1.40	1.00	.82
20			.97	.91	.98	.87	.90	1.05	2.00	1.00	.95
21 - 24			1.33	1.26	1.34	1.19	1.36	1.48	1.73	1.56	1.31
25 - 29			2.02	1.89	2.08	1.84	2.03	2.32	2.06	2.25	1.99
30-34			2.87	2.70	3.12	2.76	2.74	3.18	2.14	2.69	2.85
35 - 39			3.80	3.53	4.19	3.74	3.48	4.00	2.48	4.30	3.75
40 - 44			4.65	4.33	5.16	4.53	4.10	4.91	4.07	5.75	4.57
45 - 49			5.38	4.93	5.85	5.32	4.63	5.67	3.75	5.26	5.25
50 - 54			6.06	5.56	6.40	6.10	5.46	6.11	3.80	6.74	5.92
55-59			6.51	6.24	6.72	6.52	6.08	6.64	2.83	6.63	6.44
60-64			6.90	6.61	6.65	6.76	6.59	6.69	4.67	9.38	6.75
65-69			7.28	6.79	6.74	7.14	6.99	7.15	4.00	7.56	7.03
70 - 74			7.25	6.86	6.66	7.19	7.00	7.22	6.00	6.14	7.02
75 - 79			7.13	6.89	6.25	7.28	7.24	7.48			6.98
80-84			6.79	6.55	5.75	6.94	6.20	6.72			6.60
85–89			6.99	6.22	5.35	6.13	7.67 ∘	6.94	l		6.44
90 and	over	• •	5.35	5.43	4.75	4.50	1.00	8.33			5.35
ALL AGE	s		3.92	3.89	4.15	4.02	3.45	4.18	2.72	4.66	3.93

In this case it will be seen that there is a well-defined maximum point at or about age 70. The decline from this point suggests, as an explanation, that the mothers of large families are not the longest livers, but the fact that the average issue increases with age to age 70, can evidently not be taken as implying that the limit of fertility is only reached at 70. Probably the age limit for fertility in women is in the neighbourhood of 55, and, consequently, the increase in averages from that age to 70 must be due either to a continued diminution in the average issue of wives reaching the limits of fertility or to a higher death rate amongst those having small families. In view of what has been already said above in respect of ages over 70 the latter explanation seems untenable, and it appears that the progression of the averages beyond the limits of fertility is due in large measure to a continued decline, as time goes on, in the size of the family. A measure of this decline can only be furnished by another Census investigation of the same nature as the present.

While the highest and lowest averages for wives for any age fluctuate from State to State

Age and Average Issue of Husbands and Wives. Commonwealth, 1911.



marked H, represents the average issue of husbands, while the broken line marked W represents the average issue of wives.

more than is the case with the corresponding data for husbands, there is throughout a general tendency for the averages in the case of Western Australia to be low and for those relating to Tasmania to rank high. In general, the averages for Tasmania and New South Wales are above those for the Commonwealth, while the averages for Western Australia and Victoria are below. Queensland and South Australian averages fluctuate, being sometimes above and sometimes below the Commonwealth average.

In Graph No. 103 a representation is furnished of the average issue of husbands and wives of each age. The figures on the base line denote ages at quinquennial intervals, those on the left margin denote average issue. The continuous line of husbands, while the broken line marked W

11. Birthplace and Average Issue of Wives.—In the succeeding table are given the average issues of wives of different birthplaces, enumerated in the several States and Territories of the Commonwealth at the Census of 1911. The figures contained in this table require to be taken with care, since, as before stated, relative fertility can only be studied thoroughly when particulars are given in respect of age. Such particulars are furnished in full detail for States, Territories and the Commonwealth, on pp. 1160 to 1183 of Volume III., and in a summary form on p. 282, hereinafter, for the Commonwealth as a whole.

The figures given in this and other tables of aggregate results not analysed according to age indicate the past experience in respect of the categories involved, but give no indication of the potentialities.

Birthplace and Average Issue of Wives, 1911.

			St	TES.			Terri	TORIES.	
BIRTHPLACE.	N.S.W.	Vic.	Q'land.	S.A.	w.A.	Tas.	N.T.	F.T.	C'wlth
AUSTRALASIA—						_			
New South Wales	3.80	3.59	4.10	2.98	3.12	3.20	1.91	4.44	3.79
Victoria	3.75	3.59	3.92	3.34	2.97	3.47	3.29	5.40	3.56
Queensland	3.19	2.95	3.28	2.93	2.86	2.99	2.59	4.00	$3.26 \\ 3.72$
South Australia	3.68	4.30	3.85	3.70	3.25	3.50	$\frac{2.69}{3.00}$	6.00	4.14
Western Australia	4.06	3.90	3.59	4.31	$\frac{4.15}{3.37}$	3.61 4.18	4.25	• •	4.07
Tasmania Northern Territory	3.59	$\frac{3.91}{4.00}$	4.02 4.29	3.61 3.45	6.00		1.90	•••	3.11
Commonwealth	3.77	3.63	3.44	3.67	3.34	4.09	2.50	4.45	3.68
New Zealand	2.93	3.00	2.92	3.14	2.72	3.21	.00		2.95
Australasia	3.76	3.62	3.44	3.67	3.32	4.08	2.48	4.45	3.67
UROPE—									1.00
England	4.43	4.93	4.76	5.44	3.80	4.69	3.29	4.14	4.66
Wales	4.82	5.38	4.87	6.12	4.12	5.50	.50	6.00	4.98 4.90
Scotland	4.65	5.29	4.88	5.45	3.84	5.31	$\begin{array}{c} 1.00 \\ 2.80 \end{array}$	$\begin{array}{c} 6.00 \\ 6.92 \end{array}$	5.27
Ireland	5.06	5.53	5.37	5.74	4.13	6.06		ļ <del> </del>	
United Kingdom	4.62	5.16	4.96	5.51	3.88	5.00	2.74	5.54	4.86
Isle of Man Other European Brit.	5.68	5.72	4.38	4.67	3.83	5.00	••	•••	5.18
Possessions	4.90	4.73	6.71	6.28	4.69	1.83	• • •	•••	5.21
Austria-Hungary	3.12	2.91	5.43	4.60	2.50	8.00	•••	• •	3.41
Belgium	2.35	1.67	3.00	3.67	1.00	9.00	• •	• • •	2.74 5.12
Denmark	4.20	3.77	5.56	5.16	3.07	5.54	•••	• •	3.50
France	3.45	3.84	3.62	3.41	$2.69 \\ 3.65$	$4.67 \\ 6.14$	2.50	8.00	6.04
Germany	5.05	5.32 2.38	6.65 5.50	$\begin{array}{c} 6.23 \\ 2.00 \end{array}$	1.67	0.14	2.50		2.98
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{2.81}{4.00}$	3.71	3.98	4.67	2.86	6.50			3.72
Italy Netherlands	3.50	4.14	2.64	4.00	3.80	3.50			3.62
Norway	3.70	3.29	5.78	4.50	2.74	1.00			4.68
Portugal	4.00	4.00					١.,	•••	4.00
Russia	4.28	4.42	3.93	5.69	3.96	4.00	••		4.26 3.73
Spain	5.18	2.88	2.85	5.25	3.49	1 2:12	• • • • • • • • • • • • • • • • • • • •		4.18
Sweden	3.11	3.44	2.12	3.67	$2.65 \\ 2.74$	5.45 6.60	• • •		4.76
Switzerland Other European	3.86	4.51	5.74	5.96		0.00	••		
Countries	4.88	3.72	4.63	2.67	4.00			<u> </u>	4.32
Europe (exclusive o United Kingdom		4.63	6.20	6.00	3.35	5.83	2.50	8.00	5.34
Europe	4.61	5.13	5.13	5.57	3.84	5.06	2.74	6.25	4.89
ASIA	4.10			4.00	2.00	4.10	4.00		4.02
British India	4.18	3.84	3.84	4.26	3.98 1.86	$oxed{4.10} 2.89$	4.00		3.11
Ceylon	4.36 4.86	$oxed{2.37}{4.00}$	$\begin{array}{ c c c c }\hline 3.71 \\ 4.67 \end{array}$	6.00 3.50	1.80	2.09	::		4.54
Hong Kong Straits Settlements	5.75	4.00	3.00	5.00	2.60	::	.00	••	3.64
Other Asiatic Britis		2.25	5.33						3.91
	1 7.00		5.00	::	::				5.00
Possessions		1					3.76		4.19
Arabia	4.00	4.57			-2.33	7.75			1.21
Arabia China	4.38	4.57 4.00	4.24 1.79	$2.75 \\ 2.00$	2.33 .69	7.75	.00		1 000
Arabia China Japan Java	$egin{array}{c} 4.38 \ 2.71 \ 2.00 \ \end{array}$	4.57 4.00 2.50	4.24 1.79 1.75	2.75	.69 9.00	1			
Arabia	4.38 2.71 2.00 4.80	4.57 4.00 2.50 1.00	4.24 1.79 1.75 9.00	2.75 2.00	.69 9.00 1.00		3.00		3.90
Arabia China Japan Java Philippine Islands Syria	4.38 2.71 2.00 4.80 4.55	4.57 4.00 2.50 1.00 4.49	4.24 1.79 1.75 9.00 4.36	2.75 2.00  5.09	.69 9.00 1.00 3.89	4.29	3.00		3.90 4.53
Arabia	4.38 2.71 2.00 4.80 4.55 2.44	4.57 4.00 2.50 1.00 4.49 1.67	4.24 1.79 1.75 9.00 4.36 4.50	2.75 2.00  5.09 .00	.69 9.00 1.00 3.89 .50	4.29	3.00		2.38 3.90 4.53 2.42
Arabia	4.38 2.71 2.00 4.80 4.55 2.44	4.57 4.00 2.50 1.00 4.49	4.24 1.79 1.75 9.00 4.36	2.75 2.00  5.09	.69 9.00 1.00 3.89	4.29	3.00		3.90 4.53 2.42
Arabia China Japan Java Philippine Islands Syria Other Asiatic C'tries Asia AFRICA—	4.38 2.71 2.00 4.80 4.55 2.44 4.31	4.57 4.00 2.50 1.00 4.49 1.67	4.24 1.79 1.75 9.00 4.36 4.50	2.75 2.00  5.09 .00	.69 9.00 1.00 3.89 .50	4.17	3.00		3.90 4.53 2.42 3.93
Arabia	4.38 2.71 2.00 4.80 4.55 2.44 4.31	4.57 4.00 2.50 1.00 4.49 1.67 3.93	4.24 1.79 1.75 9.00 4.36 4.50 3.76	2.75 2.00  5.09 .00 4.41	.69 9.00 1.00 3.89 .50 2.73	4.17	3.00		3.90 4.53 2.42 3.93 4.01 4.24
Arabia	4.38 2.71 2.00 4.80 4.55 2.44 4.31	4.57 4.00 2.50 1.00 4.49 1.67	4.24 1.79 1.75 9.00 4.36 4.50	2.75 2.00  5.09 .00	.69 9.00 1.00 3.89 .50	4.17	3.29		3.90 4.53 2.42 3.93 4.01 4.24 3.05
Arabia	4.38 2.71 2.00 4.80 4.55 2.44 4.31	4.57 4.00 2.50 1.00 4.49 1.67 3.93 4.13 4.17	4.24 1.79 1.75 9.00 4.36 4.50 3.76	2.75 2.00  5.09 .00 4.41 7.78 4.11	.69 9.00 1.00 3.89 .50 2.73 5.80 3.89	4.17	3.00		3.90 4.53 2.42 3.93 4.01 4.24 3.05 5.33
Arabia	4.38 2.71 2.00 4.80 4.55 2.44 4.31 3.35 4.23 2.17 10.00 1.33	4.57 4.00 2.50 1.00 4.49 1.67 3.93 4.13 4.17 3.69 3.00 1.00	4.24 1.79 1.75 9.00 4.36 4.50 3.76 3.14 4.83 3.00	2.75 2.00  5.09 .00 4.41 7.78 4.11 3.67 	.69 9.00 1.00 3.89 .50 2.73 5.80 3.89 2.38	4.17 2.33 5.50 4.50	3.00		3.90 4.53 2.42 3.93 4.01 4.20 3.02 5.33 1.50
Arabia China Japan Java Java Philippine Islands Syria Other Asiatic C'tries Asia  AFRICA— Cape of Good Hope Mauritius Natal Orange Free State Transvaal S. Africa (undefined)	4.38 2.71 2.00 4.80 4.55 2.44 4.31 3.35 4.23 2.17 10.00 1.33 3.06	4.57 4.00 2.50 1.00 4.49 1.67 3.93 4.13 4.17 3.69 3.00	4.24 1.79 1.75 9.00 4.36 4.50 3.76 3.14 4.83 3.00	2.75 2.00  5.09 .00 4.41 7.78 4.11 3.67	.69 9.00 1.00 3.89 .50 2.73 5.80 3.89 2.38	4.29  4.17 2.33 5.50 4.50	3.00		3.90 4.53 2.42 3.93 4.01 4.20 3.02 5.33 1.50 3.10
Arabia China Japan Java Philippine Islands Syria Other Asiatic C'tries  Asia  AFRICA— Cape of Good Hope Mauritius Natal Orange Free State Transvaal S. Africa (undefined) Other African Britis	4.38 2.71 2.00 4.80 4.55 2.44 4.31 3.35 4.23 2.17 10.00 1.33 3.06	4.57 4.00 2.50 1.00 4.49 1.67 3.93 4.13 4.17 3.69 3.00 1.00	4.24 1.79 1.75 9.00 4.36 4.50 3.76 3.14 4.83 3.00	2.75 2.00  5.09 .00 4.41 7.78 4.11 3.67 	.69 9.00 1.00 3.89 .50 2.73 5.80 3.89 2.38	4.17 2.33 5.50 4.50	3.00		3.96 4.53 2.42 3.93 4.00 4.22 3.00 5.33 1.56 3.16
Arabia China Japan Java Philippine Islands Syria Other Asiatic C'tries  Asia  AFRICA— Cape of Good Hope Mauritius Natal Orange Free State Transvaal S. Africa (undefined) Other African Britis Possessions	4.38 2.71 2.00 4.80 4.55 2.44 4.31 3.35 4.23 2.17 10.00 1.33 3.06 3.06	4.57 4.00 2.50 1.00 4.49 1.67 3.93 4.13 4.17 3.69 3.00 1.00 3.10	4.24 1.79 1.75 9.00 4.36 4.50 3.76 3.14 4.83 3.00 3.00 	2.75 2.00  5.09 .00 4.41 7.78 4.11 3.67  3.00 2.75	5.80 3.89 2.73 5.80 3.89 2.38  3.33	4.17 2.33 5.50 4.50  3.28	3.00		3.90 4.53 2.42 3.93 4.00 4.22 3.03 5.33 1.50 3.10 4.70 2.10
Arabia China Japan Java Philippine Islands Syria Other Asiatic C'tries  Asia  AFRICA— Cape of Good Hope Mauritius Natal Orange Free State Transvaal S. Africa (undefined) Other African Britis Possessions	4.38 2.71 2.00 4.80 4.55 2.44 4.31 3.35 4.23 2.17 10.00 1.33 3.06 3.06	4.57 4.00 2.50 1.00 4.49 1.67 3.93 4.13 4.17 3.69 3.00 1.00 3.10	4.24 1.79 1.75 9.00 4.36 4.50 3.76 3.14 4.83 3.00 3.00 3.24 7.50	2.75 2.00  5.09 .00 4.41 7.78 4.11 3.67  3.00 2.75	5.80 3.89 2.73 5.80 3.89 2.38  3.33	4.29 4.17 2.33 5.50 4.50  3.28	3.00		3.90 4.53 2.42 3.93 4.01 4.29 3.02 5.33 1.56 3.10

Birthplace and Average Issue of Wives, 1911—continued.

			STAT	ES.			Terri'	TORIES.	
BIRTHPLACE.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlT
AMERICA—								·	İ
Barbadoes	2.67		1.00		6.00		 		3.00
Canada	3.11	3.63	4.64	3.88	2.80	4.20		::	3.55
Jamaica	3.25	3.00	3.50	3.00	5.00	1.00		::	3.44
Newfoundland	9.75	3.83	1.67	.00	4.50	1.00			4.75
Other Amer. Brit. Poss.	4.80	3.85	4.17	8.25	3.78	12.00	::	::	4.70
Argentine Republic	2.67	• • •		3.00	00	1.00			2.29
Brazil	7.00	5.13	5.00	2.00	.00			::	4.79
Chile	3.00	5.00	2.00	2.00				::	3.50
Mexico	4.17		1.50	12.00	.00			:;	4.00
Peru	8.00	3.00	4.50		1.00	::		.:	4.20
United States of Amer.	3.32	3.97	3.90	3.86	3.19	3.07			3.60
Other Amer. C'tries	4.96	4.48	5.43	5.83	5.29	5.75			5.04
America	3.40	3.91	4.10	4.10	3.25	3.69			3.69
POLYNESIA—									
Fiji	2.65	2.76	2.83	3.40	1.00	3.20			2.69
Friendly Islands	4.44	2	2.00	8.75	1.00		::	.:	5.09
Papua	7.00	• •	1.33			••			2.75
Other Pol. Brit. Poss.	6.33		4.80	• •	•••	• •	• •		5.38
New Caledonia	3.36	4.29	3.57	1.67	.67	••	::	• • •	3.27
New Hebrides	3.50	5.50	3.13			••			3.57
Samoa	3.43		4.22	••	6.00			1	4.00
Other Polynesian Is.	4.18	3.67	4.71	• •	6.00	•••	•••		4.45
Sth. Sea Is. (so desc.)	5.66	• • •	2.89	• •	11.00	••	• • •	::	3.31
Polynesia	3.34	3.18	3.36	4.75	2.78	3.20	••	•••	3.35
At Sea	5.56	5.48	4.81	5.48	4.57	6.00	2.00		5.35
All Birthplaces	3.92	3.89	4.15	4.02	3.45	4.18	2.72	4.66	3.93

An interesting item in connexion with this table and the more detailed tables from which it has been compiled, is the fact that although, as pointed out in the preceding pages, wives enumerated in Western Australia have in general been below those enumerated in other States, as regards average issue, this does not apply to the Western Australian-born wives, who, when full details are taken into account, rank remarkably high in this respect, much higher indeed than those born in any other of the States or the United Kingdom. In fact, the only numerously represented birthplace shewing higher average issues for the more important age-groups is Germany.

The succeeding table furnishes for the Commonwealth as a whole a summary of the average issues of wives, tabulated according to birthplace and age:—

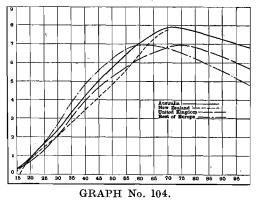
Age, Birthplace and Average Issue of Wives, 1911.

			A	verage Is	SUE OF	Wives B	ORN IN			ALL
Ages of Wives.	Aus- tralia.	New Zealand.	United King- dom.	Rest of Europe.	Asia.	Africa.	America	Poly- nesia.	At Sea.	BIRTH- PLACES
Under 14	.00									.00
14	.29		.00	• •	••	•••	••			.28
15	.27		.00		• •	••	••	• •	••	.27
16	.50	.00	1.00	.50	• •	•••	••	• •		.50
17	.59	.40	.29	.60	.50	••	.00	• •		.58
18	.68	.79	.47	.55	1.00	.00	.00		• •	.68
19	.83	.71	.50	.55	1.00	.00	.40	1.00	• •	.82
90	.95	.82	.72	1.08	1.33	.33	1.13	.67	• •	.95
$20 \dots 21-24 \dots$	1.32	1,15	.99	1.20	1.65	1.42	96	1.22	1.40	1.31
25-29	2.02	1.76	1.71	2.15	2.69	1.88	1.52	1.86	2.06	1.99
30-34	2.89	2.45	2.56	3.23	3.22	2.77	2.10	2.98	2.70	2.85
35-39	3.80	3.13	3.50	4.40	3.82	3.01	3.05	3.15	3.53	3.75
40-44	4.63	3.82	4.34	5.16	4.46	4.18	3.55	3.10	4.36	4.57
45-49	5.33	4.50	4.97	5.97	4.56	5.11	4.09	5.39	5.62	5.25
50-54	6.10	5.13	5.48	6.41	5.03	5.13	4.68	4.48	6.36	5.92
55-59	6.78	6.12	6.01	6.97	4.71	5.66	5.79	3.50	6.82	6.44
60-64	7.28	6.81	6.40	6.70	6.55	6.48	6.36	7.11	7.67	6.75
65-69	7.75	7.69	6.70	6.94	6.4	5.50	5.64	7.50	8.74	7.03
70-74	7.88	8.88	6.90	6.68	8.93	5.71	6.24	2.00	7.10	7.02
75 70	7.72		6.96	6.38	$\begin{array}{c} \textbf{3.33} \\ \textbf{7.29} \end{array}$	2.50	8.55		3.25	6.98
00 04	7.55	2.00	6.59	5.59	3.00	1	8.50	•••	.00	6.60
80-84 85-89	7.29		6.43	5.69	3.00		6.00			6.44
90 and over	9.00		5.47	6.50	3.00	•••	0.00			5.35
All Ages	3.68	2.95	4.86	5.34	3.93	3.49	3.69	3.35	5.35	3.93

FAMILIES.

This table indicates that, contrary to the opinion very generally held, the average issue of Australian-born wives is, for all ages, with the unimportant exception of age 16, considerably

Age, Birthplace, and Average Issue of Wives. Commonwealth, 1911.



higher than that of wives born in the United Kingdom, but resident in Australia. On the other hand, for the important range of ages from 25 to 60, the average issue of Australian wives is decidedly below that of wives resident in Australia who had been born in other parts of Europe than the United Kingdom. This latter is influenced very largely by the preponderance of Germanborn wives included therein, whose average issues rank highest amongst countries numerously represented.

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Graph No. 104 furnishes a representation of the average issue at each age attained for wives who had been born in (i.) Australia, (ii.) New Zealand, (iii.) the United Kingdom, and (iv.) the rest of Europe, and who were enumerated at the Commonwealth Census of 1911. The figures on the base line denote ages at quinquennial intervals,

while those on the left margin denote average issue. The birthplaces represented by the different types of line are indicated on the graph.

Of the four parts of the United Kingdom represented amongst the birthplaces of wives, Wales had in general the highest average issue, England the lowest, and Scotland and Ireland ranked fairly together.

12. Religion and Average Issue of Wives.—The next table furnishes particulars concerning the average issue of wives of different religions and denominations irrespective of age. Full details in respect of religion and age for all the States and Territories will be found in Vol. III., pp. 1144 to 1159, and in a summarised form for the Commonwealth as a whole on p. 284 hereinafter:—

Religions and Average Issue of Wives, 1911.

70			Sta	TES.			TERRIT	CORIES.	G'
Religion.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'with
CHRISTIAN-									
Church of England	3.85	3.76	3.96	3.76	3.39	4.14	2.53	4.30	3.82
Presbyterian	3.82	3.79	4.01	3.83	3.17	3.89	1.57	4.88	3.80
Methodist	4.15	4.09	4.18	4.12	3.68	4.20	2.83	5.47	4.10
Baptist	3.96	3.81	4.37	3.94	3.60	4.10	2.00	• •	3.95
Congregational	3.73	3.72	4.06	3.77	3.50	3.92	1.60		3.77
Lutheran	4.22	4.65	5.37	4.74	3.38	3.59	2.50		4.87 -
Church of Christ	3,93	3.95	4.29	3.90	3.54	5.00	1.00		3.95
Salvation Army	4.46	4.54	4.76	4.90	4.16	4.17		• • • • • • • • • • • • • • • • • • • •	4.56
Seventh Day Advent.	4.08	4.46	4.98	4.68	4.30	4.89	::	• • •	4.43
Unitarian	3.81	4.32	4.96	4.12	4.00	3.73	1.00		4.07
Protestant(undefined)	3.58	3.60	4.01	4.09	3.32	4.30	4.00	1.75	3.74
Roman Catholic	4.12	4.13	4.29	$\substack{4.03\\4.27}$	3.58	4.46	3.66	5.08	4.14
0 1 0 1 1	4.12	$\begin{array}{c} 4.13 \\ 3.85 \end{array}$	4.29	5.77	3.43	$\frac{4.40}{4.00}$			4.30
Catholic (undefined)							.50	5.00	3.85
Ott.	3.89	$\frac{3.78}{2.79}$	3.66	3.94	3.40	4.44			
Others	4.14	3.78	4.51	4.34	3.73	4.40	.00	••	4.15
All Christian	3.94	3.90	4.16	4.03	3.47	4.19	2.69	4.66	3.95
NON-CHRISTIAN-		_	-			<del></del>			
Hebrew	3.23	3.44	3.47	3.60	3.52	2.56	١		3.36
Confucian	6.00	2.50	4.00	•••	1.75		3.17		3.32
Mohammedan	1.69	4.29	1.56	4.09	2.00		6.00		2.34
Buddhist	2.80		2.00		.70	8.00	.00		1.31
Pagan	2.00	• •	4.67	8.00	2.00	0.00			3.40
Others	2.62	2.77	3.93	3.07	2.60	1.71		::	3.02
All Non-Christian	3.19	3.42	3.20	3.61	3.11	2.55	3.02	•••	3.27
INDEFINITE									
Freethinker	3.00	2.82	3.39	3.00	2.89	4.00			3.03
Agnostic	2.56	2.76	4.34	2.76	3.71	2.50	.00		3.00
No Denomination	3.83	3.85	3.39	3.13	4.45	4.59			3.84
Others	3.88	3.80	4.21	3.25	3.59	3.58			3.80
All Indefinite	3.53	3.58	3.91	3.11	3.70	4.04	.00	•••	3.59
NO RELIGION—		<del></del>	<u> </u>		<del>-</del>			· · · · · · · · · · · · · · · · · · ·	-
37 73 11 1	2.71	2.99	0.00	9.60	9.60	E E0			3.10
	2.71		3.66	3.69	2.68	5.50	••	• •	3.31
0.1	3.80	$\frac{2.50}{4.22}$	5.50	3.00	4.67	• •	• •	• •	
Others	3.80	4.33	5.00	• •	••	••		•••	4.11
All No Religion	2.71	2.99	3.78	3.67	2.75	5.50	••		3.13
ALL RELIGIONS	3.92	3.89	4.15	4.02	3.45	4.18	2.72	4.66	3.93

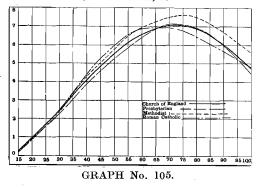
It will be seen that for the Commonwealth as a whole the largest average issue was in the case of the Lutheran Church, and that amongst the denominations and religions which were numerously represented, Hebrew wives had the lowest average issue. A high average on the part of Lutherans was in evidence in the States of New South Wales, Victoria, Queensland, and South Australia, and a low average on the part of the Hebrews was in evidence in the same four States as well as Tasmania. From the succeeding table, which gives for the Commonwealth an analysis of average issues according to religion and age of wives, it will be seen that Lutheran wives had the highest averages for the important range of ages from 25 to 60, and that, with unimportant exceptions, Hebrew wives had the lowest averages for all ages between 19 and 75.

Age, Religion, and Average Issue of Wives, 1911.

							01 .						
Ages of Wives.	Church of England.	Presbyterian	Methodist.	Baptist.	Con- gregational.	Lutheran.	Church of Christ.	Salvation Army.	Protestant (undefined).	Roman Catholic.	Catholic (undefined).	Hebrew.	All Religions.
Under 14  14 15 16 17 18 20 21-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85-89 90 and over		1.00 .17 .41 .52 .72 .86 .95 1.24 1.85 2.65 3.49 4.95 5.54 6.17 6.59 7.04 7.12 6.82 7.08 6.19 5.00			1.00 .90 .90 .88 .87 1.03 1.61 2.54 3.33 4.50 5.20 5.79 6.13 6.68 6.27 6.48 6.13 7.83			1.50 .33 .82 .79 1.35 2.16 3.08 4.12 5.96 6.32 6.79 7.22 7.45 8.56 8.92 8.00 12.00				1.00 .50 1.00 .61 1.04 1.71 2.38 3.06 3.61 4.51 4.99 6.72 6.16 7.33 7.86 1.67	.00 .28 .27 .50 .58 .68 .95 1.31 1.99 2.85 3.75 5.25 5.92 6.44 6.75 7.03 7.02 6.98 6.60 6.44 5.35
ALL AGES	3.82	3.80	4.10	3.95	3.77	4.87	3.95	4.56	3.74	4.14	3.85	3.36	3.93

Amongst the four denominations most numerously represented, viz., Church of England, Presbyterian, Methodist, and Roman Catholic, the variations at the different ages were not very marked, the most notable being the relatively high average issues in the case of Methodist wives aged 60 and upwards. Of the four mentioned, Roman Catholic wives had the highest

Age, Religion, and Average Issue of Wives. Commonwealth, 1911.



average issues for all ages from 30 to 60, and were practically on a par with Church of England wives for highest average between the ages of 20 and 30.

In the accompanying Graph (No. 105) is furnished a representation of the average issue of wives of each age whose religions were (i.) the Church of England, (ii.) Presbyterian, (iii.) Methodist, and (iv.) Roman Catholic. The figures on the base line denote ages at quinquennial intervals, while those on the left margin denote the average issue. The religions represented by the different types of line are indicated on the graph. From the fact that the dispersion of the curves in Graph No. 104 is much greater than is the case in Graph No. 105, it follows that the birthplace of the mother exercises greater influence on the number of issue than her religion does.

13. Duration of Marriage and Average Issue of Wives.—In the following table is given for each State and Territory of the Commonwealth the average issue of marriages of given duration:

		$\mathbf{D}_{\mathrm{U}}$	ration of	Existing	Marriage a	nd Avera	ige Issue (	of Wives,	1911.		
Dur	ATION O	F			STA	res.			TERRIT	rories.	<u> </u>
EXISTING	3 MARRI	AGE.	N S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH
Under 5	Years		.89	.87	.92	.86	.85	.98	1.04	.95	.89
5-9			2.28	2.22	2.41	2.27	2.22	2.48	1.87	2.89	2.29
10 - 14			3.34	3.24	3.56	3.32	3.28	3.61	2.91	3.75	3.34
15 - 19			4.26	4.06	4.63	4.26	4.02	4.52	2.73	5.79	4.24
20-24			5.07	4.81	5.54	5.10	4.85	5.36	3.32	5.45	5.05
25 - 29			5.86	5.63	6.37	5.95	5.57	6.29	7.25	5.96	5.87
30 - 34			6.69	6.48	7.04	6.68	6.36	7.00	3.75	7.24	6.67
35 - 39			7.33	7.07	7.32	7.22	7.13	7.62	5.75	8.18	7.25
40 - 44			7.97	7.47	7.58	7.72	7.95	7.99	5.50	6.20	7.74
<b>4</b> 5 and	over	• •	8.69	8.14	8.08	8.34	8.39	8.55	4.00	7.25	8.37
ALL PI	RIODS		3.77	3.74	3.98	3.88	3.30	4.04	2.50	4.53	3.78

FAMILIES. 285

The figures given in this and the succeeding table relate solely to the issue of the marriages which were in existence at the date of the Census, whereas those contained in the other tables relate, unless otherwise indicated, to the total issue of first, second and other marriages. The average issues for the several States are consequently somewhat lower in this table than in preceding ones. These differences, which represent the average issue of marriages prior to that existing at the date of the Census, are as follows:—New South Wales, Victoria, Western Australia and the Commonwealth as a whole, .15; Queensland, .17; South Australia and Tasmania, .14; Northern Territory, .22; and Federal Territory, .13. These figures indicate that approximately 96 per cent. of the total issue of wives had arisen from existing, and about 4 per cent. from previous marriages.

The largest average issues for the successive durations are in general found in the cases of Tasmania and Queensland, and the lowest in Victoria and Western Australia.

In the above table the average issue is treated as a function of duration of marriage only. Details for variation with age and duration in combination will be found for the Commonwealth as a whole, and separately for its several component States and Territories in Volume III., pp. 1184 to 1187. A summary of such combined particulars for the Commonwealth as a whole is given in the next table:—

Age, Duration of Existi	ig <b>M</b> arriage, and	Average Issue of	Wives, 1911.
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	_			Dur	ATION O	F Existi	NG MAR	RIAGE.				All
AGES OF V	Vives.	Under 5 years	59	10–14	15–19	20-24	25-29	30-34	35–39	40–44	45 and over.	Periods
Jnder 14		.00										.00
14		.28	• • .									.28
15		.27		!	• •				• • •			.27
16		.50										.50
17		.58	• •	• •	• •	٠.	٠.	• • •		• •		.58
. 18	٠.	.68	2.00	• • •	• •	• • •	• • •	• • •	• • •			.68
19	• •	.82	3.38	• •	• •	• •	• •			• •		.82
20	• •	.89	2.26		• •	• • •	• •		• •	••		.95
21-24	• •	.98	2.45	4.92	• •	• • •			• •			1.30
25-29	٠.	.97	2.51	3.76	5.86		• •			• •		1.9'
30-34	٠.	.89	2.37	3.69	4.84	6.29		• •	• •	• •		2.80
35–39	• •	.70	2.16	3.47	4.73	5.85	6.88		• •	• •	• • •	3.6
40-44	• •	.35	1.60	2.96	4.27	5.60	6.89	8.40	_•	• •		4.4
45-49	• •	.07	.66	1.96	3.37	4.85	6.37	7.69	7.57			5.0
50-54	. • •	.00	.09	.80	2.25	3.84	5.54	7.17	8.65	11.22	10.00	5.65
55-59	• •	.00	.00	.14	.90	2.52	4.32	6.17	7.80	9.19	10.00	6.0
60-64	• •	.00	.00	.00	.07	.93	2.70	4.68	6.42	8.25	9.52	6.3
65-69	٠.	.00	.00	.00	.01	.12	.90	2.82	4.78	6.88	8.82	6.5
70-74	• •	.00	.00	.00	.00	.01	.10	1.27	2.93	4.95	8.18	6.48
75-79	٠.	.00	.00	.00	.00	.00	.00	.11	1.13	3.32	7.57	6.3
80-84	• •	.00	.00	.00	.00	.00	.00	.00	.04	1.75	6.80	5.9
85-89	٠.	.00	.00	.00	.00	.00	.00	.00	.00	.88	6.57	5.84
90 and	over	••		••-	.00	.00	• •	.00	.00	.00	4.70	4.2
ALL AGE	s	.89	2.29	3.34	4.24	5.05	5.87	6.67	7.25	7.74	8.37	3.7

In connexion with the regular progression shewn in the two preceding tables in the average issue in relation to duration of marriage, it appears certain that in the absence of a marked and extensive decline in the average issue at the limiting age of fertility, the average issue could not increase with age to the limits of the table in the manner and to the extent shewn above. If, as appears probable, fertility is practically nil beyond 30 years' duration, and absolutely so beyond 40, the average issue for the duration 30-34, 35-39, 40-44, and 45 and over, would be nearly equal if birth rates had not been subject to a continuous diminution. The only other possible explanation is that parents of small families do not live as long as parents of large families, and for this assumption there is no warrant, statistical or other.

14. Occupation and Average Issue of Husbands.—An analysis of the statistics of average issue according to the occupation of the husbands was carried out in connexion with the present Census. The analyses contained in the preceding sections have been based on the birthplace, religion, and duration of marriage of wives, but the same cannot be done in the case of occupation, since the controlling factor is usually the occupation, not of the wife herself, but of her husband. The majority of wives are classed as to occupation under the head of "domestic duties." In the case of wives living with their husbands at the time of the Census, it would be possible, by making provision on the "Conjugal" card for the occupation of the husband, to tabulate issue data according to the age of the wife, and the occupation of her husband. This, however, in addition to involving extra labour and inconvenience as mentioned on p. 261, would have necessitated the abandonment of some 15 per cent. of the data owing to absentees. Even if complete, it did not appear likely to furnish any better evidence of the relation between occupation and issue than was obtainable more readily from the personal card of the husband. Particulars in respect of occupation and issue were consequently tabulated from the personal cards for males at the stage when the tabulation of occupations was in hand.

The tables so compiled have been based on an abridged classification of occupations, and appear according to grades, ages, and States or Territories of enumeration on pp. 1188 to 1203 of Volume III. A summary for all ages combined is given in the succeeding table for the several States and Territories, in accordance with the abridged classification mentioned above:—

Occupation and Average Issue of Husbands, 1911.

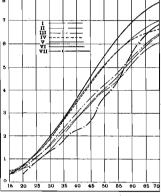
	TION.	OCCUPATION.			STA	TES.			TERRI	TORIES.	C'WLTH
Order	Sub- Order	Description.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	
,		CLASS I.—PROFESSIONAL.									
1 2		Engaged in Government, Defence, Law, etc Ministering to Religion, Charity, Health,		3.61	3,85	3.74	3.12	3.85	2.69	3,11	3.60
		Education, etc	3.19	3.29	3.26	3,42	2.78	3.31	1.88	3.60	3,22
		TOTAL—CLASS I	3.34	3.40	3.49	3.54	2.93	3.53	2,24	3.29	3,37
٤	1 2	CLASS II.—DOMESTIC. Engaged in supplying Board and Lodging ,, Domestic Service & Attendance	3.34 3.07	3,27 3.05	3.57 3.33	3.37 3.43	2.80 2.79	3.73 3.99	2.40 1.78	8.00 4.00	3,32 3,13
1		TOTAL—CLASS II	3.22	3.16	3.49	3.40	2.79	3.83	1.91	5,33	3.24
4 5 6		CLASS III.—COMMERCIAL. Dealing in Property and Finance Art and Mechanic Productions Textile Fabrics, Dress and	4.02 2.93	3.71 2.94	4.06 3.06	4.32 3.01	3.37 2.71	4.05 2.89	::	8.50	3.91 2.94
7		Fibrous Materials	2.78	2.92	3.06	2.81	2.59	2.92	.00	••	2.86
8		Stimulants	3 28	3.32	3.51	3,65	2.90	3.71	1.95	••	3.34
9 10 11 12		Substances, N.E.I. , Fuel and Light , Metals and other Minerals General & Undefined Merchants & Dealers Speculators on Chance Events	3.29 3.95 2.87 3.33 2.52	3.40 4.02 2.99 3.46 2.58	3.59 4.02 3.13 3.62 2,19	3.53 4.10 3.11 3.60 5.00	3.18 3.73 2.60 3.07 1.69	3,46 4,09 2,87 3,77 2,65	4.00 .00 2.69	4.00  2.00	3.38 4.00 2.95 3.43 2.48
13		Engaged in Storage	3.52	3.61	5.43	4.21	3.02	6.33	••	<u>··</u>	3.79
		TOTAL—CLASS III	3,35	3.36	3.56	3.62	3.00	3.63	2.46	4.50	3.39
14	1 2 3	CLASS IV.—TRANSPORT & COMMUNICATION Engaged in Railway Traffic ,, Traffic on Roads ,, Seas and Rivers	3.67 3.59 3.22	4.02 3.58 3.35	4.12 4.10 3.65	4.08 3.84 3.53	3.31 3.26 2.93	4.24 3.82 3.88	2.94 3.18 2.57	2.50 6.33 4.00	3.86 3.67 3.35
[4	1 & 5 6	,, Postal, Telegraph and Tele-	3,20	3.20	3.56	3.01	2,63	3.17	2.07		3.18
	. 6	Messengers, etc	4.14	3.74	6.75	6.20	3.50	5.25	···	••	4,47
		TOTAL—CLASS IV	3.48	3.69	3.95	3.77	3.14	3.91	2.68	4.57	3.61
15 16		CLASS V.—INDUSTRIAL. Working in Art & Mechanic Productions	3.43	3,34	3.75	3.52	3.35	3.59	3.00	.75	3.45
17	1	", Textile Fabrics, Dress, and Fibrous Materials".  ", Food, Drinks, Narcotics, and	3.66	3.62	3.79	4.01	3.58	4.22	1.27	.00	3,70
18		Stimulants	3,35	3.41	3.56	3.64	3.20	3.91	2.75	4.50	3.44
19 20		stances, N.E.I.  Metals and other Minerals  Fuel, Light, and other forms of	3.87 3.68	3.73 3.72	4.15 3.92	4.13 3.90	3.35 3.61	4.02 4.12	.50	5.00	3.86 3.75
21		Energy Engaged in Construction of Buildings,	3.34	3.28	3.32	3,06	2.63	3.83	2.00	2.00	3.27
22 23		Roads, Railways, etc ,, Disposal of the Dead or of Refuse ,, Undefined Industrial Pursuits	4.02 4.25 4.26	3.98 4.35 4.21	4.25 4.94 4.30	4.22 4.71 4.47	3.93 4.12 3.74	4.29 4.92 4.37	3.22 1.95	4.40 4.22	4.06 4.44 4.24
		TOTAL—CLASS V	3.77	3.73	3.97	3.97	3.60	4.13	2.18	4.00	3.81
24	1 2 8	CLASS VI.—PRIMARY PRODUCERS. Engaged in Agricultural Pursuits ,, Pastoral Pursuits ,, Capture, etc., of Wild Animals.	4.69 4.60	4.55 4.46	4.57 4.43	4.58 4.26	3.86 3.18	4.84 4.48	2.00 2.44	4.67 5.06	4.57 4.49
	4	and their Produce Fisheries	4.24 4.61	4.35 4.51	3.74 3.63	4.62 3.86	$\frac{3.17}{2.74}$	4.36 4.91	$\frac{3.00}{2.82}$	5.00	4.18 4.16
- 1	5 6	Forestry Water Conservation & Supply	4.20 3.80	4.05 4.07	4.14 3.98	4.36 4.00	3.21 2.94	4.07 4.03	.00 4.00	6.00 3.00	3.94 3.87
	7	" Mining and Quarrying	3.99	4.45	3.97	4.38	3.11	3.58	2.08	5.00	3.94
)	Ì	TOTAL—CLASS VI	4,46	4.49	4,36	4.51	3,43	4,50	2.19	4.93	4.37
25		CLASS VII.—INDEPENDENT	6.39	5.98	6.34	6.73	6.08	6.57	5.00	3.00	6.27
		Total—Breadwinners	3.87	3.87	4.05	4.04	3,32	4.20	2.25	4.61	3.89
26 27	1	CLASS VIII.—DEPENDENTS. Dependent on Natural Guardians Supported by Voluntary or State Contri-	5.80	6.01	6.44	6.03	5.91	5.96		6.00	5.98
	2	bution Criminal Class (under Legal Detention)	2.95	4.67 2.14	1.69 13.00	4.91	2.90 2.33	2.93	::	::	3. <b>6</b> 8 2.78
		TOTAL—CLASS VIII	5.38	5.23	5.28	5.57	4.78	4.95	···	6,00	5,26
		ALL OCCUPATIONS	3.90	3.90	4.07	4.07	3.34	4.23	2,25	4.60	3.91

In this, as in other cases, aggregate results require to be used with caution. Thus the table indicates that Class VII., "Independents," and Class VIII., "Dependents," exhibited the highest average issues. As a mere statement of fact this is correct, but it does not warrant the conclusion that these Classes are the most reproductive, since the largeness of average issue is mainly due to the large proportion of husbands of advanced age contained therein. On the other hand, the husbands of Class VI., "Primary Producers," had for the Commonwealth as a whole, and also for all States except Western Australia, a considerably higher average issue than was exhibited by any other Class except VI. or VII. In this case the analysis of the results according to age indicates that the Class of "Primary Producers" is much more reproductive than any other, including Classes VII. and VIII. A summary for the Commonwealth of particulars in respect of Class of Occupation and Age is given in the next table:—

Occupation	Age and	Average Issue	of Husbands	. Commonwealth,	1911.
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							BREAL	WINNER	ıs.				
	AG	· E.		Class I. Professional.	Class II. Do- mestic.	Class III. Com- mercial.	Class IV. Transport & Communication.	Class V. Indus- trial.	Class VI. Prim- ary Pro- ducers	Class VII. In- depen- dent.	All Bread- winners	Class VIII. Depen- dents.	All Occupa tions.
1 <b>5</b> –19				.53	.44	.51	.55	.58	.50		.54	.75	.54
20-24			• • •	.69	.82	.87	.94	.95	.97	.63	.93	.53	.93
25-29	• •	• •	• •	1.12	1.34	1.33	1.51	1.50	1.55	1.13	1.47	1.30	1.47
30-34				1.76	1.89	2.00	2.27	2.28	2.35	1.53	2.21	1.53	2.21
35–39				2.43	2.51	2.66	3.04	3.10	3.25	2.11	3.01	3.00	3.01
40-44				3.13	3.08	3.33	3.88	3.94	4.13	2.40	3.82	2.55	3.81
45-49				3.77	3.73	3.97	4.67	4.71	5.07	3.22	4.61	4.59	4.61
50-54				4.33	4.18	4.48	5.40	5.40	5.88	4.02	5.31	4.30	5.30
55–59				4.99	4.78	5.15	6.08	6.01	6.61	5.13	5.99	4.65	5.98
60-64				5.63	5.47	5.70	6.31	6.46	7.18	6.04	6.51	6.67	6.50
<b>65</b> and	$\mathbf{over}$	• •		6.50	5.93	6.58	6.66	6.98	7.76	6.85	7.14	6.72	7.13
ALL	Ages			3.37	3.24	3.39	3.61	3.81	4.37	6.27	3.89	5.26	3.91

# Class of Occupation, Age, and Average Issue of Husbands. Commonwealth, 1911.



GRAPH No. 106.

It will be seen that for every age-group except the unimportant group of 15-19, the average issue for "Primary Producers" was higher than for any other Class, and that husbands in the "Industrial" Class ranked next in respect of reproductivity.

Amongst breadwinners the lowest average issues for the different ages occurred amongst those in the "Independent" Class, the "Domestic" Class and the "Professional" Class. Husbands in the "Commercial" and "Transport" Classes occupied a middle position in this respect, and the average issues for the Transport Class accorded closely at nearly all ages with the average for all occupations combined.

Graph No. 106 furnishes a representation of the average issues of husbands of different occupations and ages. In this graph I. denotes Professional Class, II. Domestic, III. Commercial, IV. Transport and Communication, V. Industrial, VI. Primary Producers, and VII. Independent. The figures on the base line denote ages at quinquennial intervals while those on the left margin denote the average issue.

A further analysis of Class VI., "Primary Producers," into the seven sub-orders for which the issue data were tabulated, furnishes the following result:—

Primary Producers.—Age and Average Issue of Husbands, Commonwealth, 1911.

	I							Average
AGE.	Agri- cultural Pursuits.	Pastoral Pursuits.	Capture, etc., of Wild Animals, and their Produce.	Fisheries.	Forestry.	Water Conserva- tion and Supply.	Mining and Quarrying.	for all "Primary Pro- ducers."
15–19	.41	.53	.00	1.00	.18	.50	.67	.50
20-24	.91	.95	1.02	1.17	1.08	.90	1.04	.97
25-29	1.46	1.51	1.88	1.88	1.69	1.48	1.68	1.55
30-34	2.28	2.28	2.59	2.62	2.53	2.10	2.48	2.35
35-39	3.22	3.17	3.53	3.30	3.39	3.11	3.35	3.25
10-44	4.10	4.17	4.14	4.26	4.36	3.79	4.15	4.13
15-49	5.08	5.08	5.37	5.24	5.57	4.59	4.96	5.07
50-54	5.99	5.83	5.92	5.58	6.44	5.15	5.66	5.88
55–59	6.71	6.68	5.89	5.85	6.92	6.35	6.28	6.61
30-64	7.31	7.15	7.16	6.26	7.68	6.94	6.82	7.18
35 and over	7.92	7.85	7.81	6.81	7.62	6.33	6.95	7.76
ALL AGES	4.57	4.49	4.18	4.16	3.94	3.87	3.94	4.37

It will be seen that the highest average issues for most ages occurred in the case of husbands engaged in Forestry, and that average issues for those engaged in Agricultural pursuits were practically identical with the averages for Pastoral Pursuits. Husbands engaged in Water Conservation and Supply had the lowest average issues at most ages.

The foregoing analyses have been based on a classification of husbands according to class of occupation. A further analysis is possible on the basis of grade of occupation, that is, according to whether the husband is an employer, a wage earner, a worker on his own account, etc. If reproductivity were largely influenced by class distinctions, it might be expected that such an analysis would disclose clearly the effect of this influence.

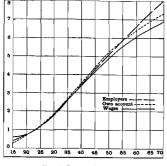
The following table contains a summarised result for the Commonwealth as a whole, of an analysis of this nature, the figures given being the average issue for each grade and age, irrespective of the class of occupation:

						G	RADE.			
	A	<b>}E.</b>		E. Employers	O. Working on own Account but not Employing Labour.	A. Assisting but not Receiving Wages or Salary.	W. In Receipt of Wages or Salary.	N. Unem- ployed.	N.A. Not Applicable.	ALL GRADES.
15-19				.64	.47	.14	.55	.46	.86	.54
20-24				.92	.95	.71	.93	.94	.70	.93
25 - 29			• •.	1.44	1.51	1.06	1.47	1.47	1.22	1.47
30 - 34				2.19	2.26	1.60	2.22	2.10	1.78	2.21
35–39				3.02	3.12	2.35	3.00	2.72	2.45	3.01
40-44				3.87	3.96	2.73	3.77	3.64	2.94	3.81
45 - 49				4.68	4.83	4.61	4.54	4.37	3.64	4.61
50-54				5.44	5.58	4.43	5.22	5.00	4.27	5.30
55-59				6.34	6.08	5.05	5.84	5.97	5.16	5.98
60-64				6.98	6.65	7.30	6.32	6.28	5.86	6.50
65 and 6	over			7.76	7.29	7.38	6.78	6.50	6.87	7.13
ALL A	GES.			4.32	4.47	3.13	3.46	3.87	5,65	3.91

Age, Grade of Occupation, and Average Issue of Husbands, Commonwealth, 1911.

The three most important groups are the employers, the workers on own account, and the The unemployed are simply wage-earners so unfortunate as to be out of work at the time of the Census, and, as might be expected, the average issue in their case does not differ materially with that for wage-earners. Those to whom grade is not applicable consist largely of dependents and independents, while those graded as assisting but not receiving wages belong in a sense to the category of dependents. These two groups have in the main relatively low average issues.

Grade of Occupation, Age, and Average Issue of Husbands. Commonwealth 1911.



GRAPH No. 107.

As regards the three more important grades, it will be seen that up to age 40 there is very little to choose between them, but that thereafter employers and workers on own account preponderate, the latter from 40 to 55, the former from 55 onward.

This is contrary to the opinion which appears to be very generally held, viz., that the wage-earners are markedly more reproductive than the other classes in the community. These figures indicate that in respect of reproductive power, the class of occupation exercises a much greater influence than the grade. For example, there is a much more marked difference in degree of reproductiveness between Primary Producers on the one hand and the Professional or the Domestic Class on the other, than there is between employers and wage-earners.

The accompanying Graph (No. 107), furnishes a representation of the average issue of husbands of each age according to grade of occupation. The relatively small dispersion of the curves in Graph No. 107 as compared with that of the curves in Graph No. 106 is striking evidence that the class of occupation exercises a much greater influence on the number of issue than does the grade of the occupation.

For the purpose of further analysing the influence of class of occupation, the following table has been prepared, shewing the average issue for each age-group and class of occupation of the husbands who were employers:—

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Age, Occupation, and Average Issue of Husbands who were Employers, Commonwealth, 1911.

				A A	AVERAGE ISS	UE OF HUS	BANDS WHO	WERE EMPLO	OYERS IN—	
Age	LAST	Birth	DAY.	Class I. Pro- fessional.	Class II. Domestic.	Class III. Com- mercial.	Class IV. Transport and Com- munication	Class V. Industrial.	Class VI. Primary Producers.	All Classes
5-19						.67	.67	.88	.50	.64
0-24				.48	.96	.80	1.10	.95	.95	.92
5-29				1.03	1.41	1.38	1.71	1.51	1.44	1.44
0 - 34			٠.	1.65	2.02	2.06	2.54	2.26	2.25	2.19
5-39				2.26	2.58	2.71	3.39	3.18	3.16	3.02
0 - 44			٠.	2.85	3.23	3.45	4.32	3.99	4.11	3.87
5-49				3.25	3.91	4.06	5.08	4.81	5.07	4.68
0-54				3.82	4.37	4.62	5.91	5.51	5.93	5.44
5-59				4.39	5.20	5.40	6.35	6.34	6.88	6.34
0-64				5.21	5.71	6.12	6.97	6.90	7.44	6.98
5 and	over	• •	• •	6.50	6.52	6.95	7.37	7.36	8.13	7.76
$\mathbf{A}_{\mathbf{L}\mathbf{L}}$	Ages			3.02	3.47	3.71	4.40	4.35	4.70	4.32

In this case the Transport Class and the Primary Producers occupy between them the leading positions, the former from 20 to 45, the latter from age 50 onwards, there being practically identity for the group from 45 to 50. Below 20 the Industrial Class predominates, but the age-group is unimportant. At all ages the Professional Class exhibits the lowest averages. At no age does it much exceed 70 per cent. of the average issue for Primary Producers, and at some ages it is considerably below that proportion.

Next to the Professional Class in this respect comes the Domestic and then the Commercial Class. The two latter run closely together to age 40, and do not markedly differ throughout the whole range. In the main the Industrial Class falls but little short of the Primary Producers and Transport Classes. The Industrial Class is that which for the grade of employers runs the most closely throughout with the averages for all classes combined.

The results of a similar analysis in respect of workers on own account is furnished in the succeeding table, which gives the average issue for each group and class of occupation of the husbands who were workers on own account:—

Age, Occupation, and Average Issue of Husbands who were Workers on Own Account, Commonwealth, 1911.

				AVERAGE	Issue of H	USBANDS W	HO WERE V	VORKERS ON	Own Acc	OUNT IN-
AGE	Last	Віктн	DAY.	Class I. Pro- fessional.	Class II. Domestic.	Class III. Com- mercial.	Class IV. Transport and Com- munication	Class V. Industrial.	Class VI. Primary Producers.	All Classes.
5-19				1.00		.43	.60	.67	.36	.47
0-24				.68	.96	.95	1.03	.94	.95	.95
5-29				1.14	1.48	1.49	1.78	1.54	1.50	1.51
0-34				1.59	1.91	2.17	2.50	2.31	2.35	2.26
5 - 39				2.08	2.85	2.83	3.55	3.14	3.31	3.12
0-44				2.73	3.33	3.42	4.28	3.88	4.32	3.96
5-49				3.31	4.03	4.05	5.46	4.71	5.29	4.83
0-54				3.73	5.02	4.45	5.97	5.34	6.21	5.58
5-59				4.26	4.58	5.05	6.54	5.93	6.69	6.08
0-64				4.95	6.23	5.58	6.69	6.38	7.25	6.65
5 and	over			5.79	5.94	6.28	7.52	6.97	7.79	7.29
ALL A	Ages			3.04	3,58	3.78	4.48	4.47	4.92	4.47

Here, as in the case of employers, the Primary Producers and Transport Classes share between them the highest average issues at all ages except 15-19, the latter predominating at the earlier ages, and the former at the later ages. At all ages except 15-19, husbands in the professional class had the lowest average issue, the domestic and commercial classes ranking next in this respect. As in the case of employers, the figures for the two classes last-mentioned run fairly closely together for successive ages, while those for the industrial class furnish throughout a fair approximation to the averages for all classes combined.

Similar results for wage-earners are furnished in the next table, which gives the average issue for each age-group and class of occupation of the husbands who were in receipt of wages or salary at the time of the Census:—

Age, Occupation, and Average Issue of Husbands who were Wage-earners, Commonwealth, 1911.

				AVERAGE ISSUE OF HUSBANDS WHO WERE WAGE-EARNERS IN-											
Age 1	LAST	Віктні	PAY.	Class I. Pro- fessional.	Class II. Domestic.	Class III. Com- mercial.	Class IV. Transport and Com- munication	Class V. Industrial.	Class VI. Primary Producers.	All Classes					
15–19				.42	.46	.54	.55	.57	.54	55					
20-24		• •		.72	.79	.88	.94	.95	.98	93					
25-29			• •	1.14	1.30	1.30	1.48	1.50	1.61	1.47					
30-34				1.83	1.81	1.96	2.24	2.29	2.41	2.22					
35-39				2.54	2.43	2.62	2.99	3.09	3.27	3.00					
10-44				3.30	2.87	3.29	3.82	3.93	4.04	3.77					
15-49			٠.	3.97	3.53	3.96	4.59	4.71	4.91	4.54					
50-54				4.55	3.94	4.50	5.33	5.42	5.60	5.22					
55-59				5.23	4,47	5.22	6.05	5.94	6.27	5.84					
30-64		٠.		5.85	5.23	5.66	6.12	6.43	6.81	6.32					
35 and	over	• •		6.50	5.85	6.54	6.28	6.92	7.12	6.78					
ALL A	Ages			3.32	2.97	2.92	3.44	3.56	3.74	3.46					

In this case the Primary Producers exhibited average issues which were markedly in excess of those for other classes at all ages except 15-19, while the figures for the Industrial Class ranked second at all ages except 15-19, for which they were first, and 55-59, for which they were third. As in the cases of employers and workers on own account, the figures for the Industrial Class furnish throughout a fair approximation to the averages for all classes combined.

For ages under 30 the Professional Class exhibited the lowest average issues, while for ages above 30 the figures for the Domestic Class occupied the lowest position. At all ages above 30 the figures for the professional class did not differ materially from those for the commercial class.

The analyses contained in the three preceding tables emphasise the fact noted on p. 288, that as regards influence on number of issue, the class of occupation plays a much greater part than the grade.

15. Age and Average Issue of Widowed and Divorced Persons.—In addition to particulars of issue of husbands and wives, those of widowed and divorced persons were also tabulated. Particulars of the average age and average issue of such persons are given in the next table for the several States and Territories of the Commonwealth.

Average Ages and Issues of Widowed and Divorced Persons, 1911.

		$\mathbf{M}_{A}$	LES.			$\mathbf{F_{EM}}$	LES.	
STATES OR '	Widowed.		Divor	CED.	WIDO	WED.	DIVORCED.	
Territories.	Average Age.	Average Issue.	Average Age.	Average Issue.	Average Age.	Average Issue.	Average Age.	Average Issue.
STATES—	vears	years	years	years	years	years	years	years
New South Wales	59.61	4.82	46.45	2.47	59.75	5.75	41.30	2.82
Victoria	62.04	4.94	46.64	2.18	61.82	5.70	42.50	2.75
$\mathbf{Queensland}$	58.78	4.67	43.35	2.27	58.58	5.72	41.62	3.84
South Australia	61.19	5.30	46.52	2.25	62.32	5.97	43.57	2.73
Western Australia	54.11	3.72	44.41	2.21	55.95	5.38	38.28	2.67
Tasmania TERRITORIES—	60.78	5.56	46.81	2.47	61.72	6.15	41.76	2.32
Northern	53.28	2.46	52.50		49.87	4.06		
Federal	56.83	4.33	72.50	11.00	61.96	6.06	42.50	6.00
Commonwealth	60.07	4.84	46.09	2.35	60.52	5.75	41.61	2.82

Details as to age for the Commonwealth as a whole are furnished in the succeeding table:—

Ages and Average Issues of Widowed and Divorced Persons, Commonwealth, 1911.

	AGE.	Mai	LES.	FEI	_		MA	LES.	FEMALES.		
Ag	Е.	Widowed.	Divorced.	Widowed.	Divorced.	Age	•	Widowed.	Divorced.	Widowed.	Divorced
15				1.00		50-54		4.38	2.86	5.36	4.20
16				.50		55-59		4.77	3.47	6.03	4.74
17		2.00		1.67		60-64		5.29	3.98	6.41	5.20
18		.50		.44	1.00	65-69		5.72	4.43	6.68	4.25
19		.00	.00	1.00		70-74		6.05	6.22	6.89	6.54
20		.64		1.14	.43	75-79		6.36	4.11	7.01	5.60
21 - 24		.94	.57	1.45	1.12	80-84		6.51	2.17	6.67	.00
25-29		1.37	1.06	1.90	1.44	85-89		6.76	11.00	6.40	2.00
30 - 34	٠.	1.82	1.26	2.46	1.68	90 and ov	er	6.31	16.50	5.85	
35 - 39		2.32	1.44	3.08	2.21		l		<del></del>		
40 - 44		3.04	1.63	3.88	2.93	ALL AGE	s	4.84	2.35	5.75	2.82
45 - 49		3.74	2.41	4.62	3.38		i				

FAMILIES.

16. Metropolitan Results.—The average issues of husbands of each age who were resident in the several metropolitan areas of the Commonwealth are furnished in the succeeding table:—

Age and Average Is	sues of	Husbands	in	Metropolitan	Areas.	1911.
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Ages of Husbands.				Average Issue of Husbands Enumerated in—									
Ages	оғ Н	JSBA1	NDS.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	All Metro- politan Areas.			
14 15				.00	•••					.00			
16				.60	.50		.00	.00		.40			
17	. • •	• •		.36	.30	• • .	.33	.00	.33	.29			
18	• •			.55	.71	.40	.55	.50	.33	.56			
19				.59	.55	.40	.61	.40	.29	.55			
20			• •	.74	.68	.79	.67	.70	.60	.71			
21-24		٠.		.93	.91	.84	.89	.83	.98	.91			
25 - 29				1.42	1.37	1.30	1.37	1.33	1.55	1.38			
30 - 34				2.05	2.03	2.11	2.11	2.05	2.29	2.06			
35 - 39	٠.			2.66	2.60	2.93	2.87	2.78	2.82	2.70			
40 - 44				3.31	3.35	3.75	3.59	3.35	3.71	3.40			
45-49			;	4.03	3.98	4.48	4.38	3.91	4.32	4.08			
50 - 54				4.67	4.51	5.10	5.09	4.48	5.25	4.69			
55-59		٠.		5.22	5.06	5.81	5.89	5.20	5.45	5.31			
60-64				5.67	5.62	6.10	6.24	5.64	5.63	5.76			
65-69				6.12	5.89	6.28	6.64	6.34	6.40	6.15			
70-74				6.55	6.37	6.86	6.67	6.84	6.76	6.55			
75 - 79	`			6.98	6.74	7.08	7.11	7.15	7.73	6.93			
80-84				6.99	7.16	7.01	7.69	7.53	7.35	7.20			
85-89				6.51	6.57	6.79	7.36	9.75	7.82	6.84			
90 and	over	٠.	• •	3.80	5.82	13.50	7.09	6.00	5.00	5.95			
ALI	AGES			3.36	3.45	3.77	3.75	3.27	3.79	3.47			

From age 20 to age 85 the highest average issue for any age will be found in one or other of the three metropolitan areas of Brisbane, Adelaide, or Hobart, while from age 20 to the end of the table the lowest average will, with one exception, be found in the metropolitan areas of Sydney, Melbourne, or Perth.

The next table furnishes similar information for wives, and gives the average issues of wives of each age who were resident in the several metropolitan areas of the Commonwealth:—

Age and Average Issues of Wives in Metropolitan Areas, 1911.

			Average Issue of Wives Enumerated in-									
Ages of	WIVE:	s.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	All Metro politan Areas.			
14	• •		.33	.00					.17			
15			.27	.29	.25	.00		1,00	.31			
16			.47	.50	.14	.63	.78	1.00	.50			
17			.58	.53	.56	.46	.65	.86	.56			
18			.63	.59	.56	.63	.59	.53	.61			
19			.80	.78	.74	.80	.88	.53	.79			
20			.91	.84	.87	.90	.71	.85	.87			
21-24			1.18	1.14	1.07	1.12	1.24	1.20	1.16			
25-29			1.75	1.70	1.71	1.70	1.91	1.92	1.74			
30-34			2.42	2.40	2.63	2.51	2.62	2.72	2.46			
35-39			3.19	3.13	3.58	3.37	3.35	3.41	3.24			
10-44			3.98	3.83	4.39	4.06	3.90	4.19	3.97			
5-49			4.57	4.39	5.01	4.83	4.47	4.72	4.57			
60-54			5.18	4.92	5.58	5.53	5.19	5.28	5.16			
5-59			5.61	5.57	6.16	5.98	5.86	5.96	5.71			
60-64			6.03	5.83	6.18	6.33	6.48	6.02	6.04			
5-69	٠.		6.49	6.09	6.31	6.52	6.75	6.64	6.36			
70-74			6.64	6.38	6.66	6.82	6.92	6.96	6.59			
75–79			6.60	6.37	6.44	7.10	6.53	7.16	6.58			
30-84			6.05	6.11	6.11	6.03	6.38	7.23	6.12			
35–89			6.77	5,90	4.17	5.05	8.25	8.50	6.00			
00 and over	• •		4.75	4.19		5.50	1.00	••	4.41			
ALL AGES			3.39	3.45	3.78	3.69	3.41	3.74	3.49			

For the majority of ages the highest average for any age was found in one or other of the three metropolitan areas of Brisbane, Perth, or Hobart, while at most ages the lowest average issue for any age occurred in the case of Melbourne. Sydney and Adelaide occupied intermediate positions in this respect, the Sydney averages running very closely at all ages with those for all metropolitan areas combined.

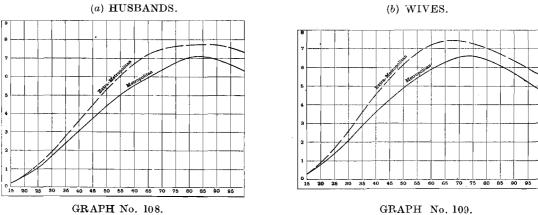
The following table, which furnishes a comparative view for each age of the average issues of husbands and wives in the metropolitan and extra-metropolitan areas of the Commonwealth, gives a good indication of the influence of urban residence on size of family. The portion of the Commonwealth classed as extra-metropolitan consists of the whole of Australia exclusive of the Capital cities and their suburbs. It consequently comprises many cities and towns of considerable size, and hence does not truly represent rural Australia in this matter. Separate data for these towns, however, are not available. If they were, it is probable that the difference shewn in the next table between metropolitan and extra-metropolitan average issues would be even more marked in a table distinguishing between urban and rural data.

Metropolitan and Extra-Metropolitan Average Issues, 1911.

Ages.			s.—Average e Enumerate			Wives.—Average Issues of those Enumerated in—				
TGES.			Extra-Metro- politan Areas.	The whole Common- wealth.	Metropolitan politan Areas	Extra-Metro- politan Areas.	The whole Common wealth.			
14				• •	.17	.33	.28			
15		.33		.13	.31	.25	.27			
16		.40	.20	.28	.50	.50	.50			
17		.29	.46	.39	.56	.59	.58			
18		.56	.50	.53	.61	.72	.68			
19		.55	.63	.59	.79	.84	.82			
20		.71	.72	.72	.87	.99	.95			
21-24		.91	97	.94	1.16	1 41	1.31			
2529		1.38	1.53	1.47	1.74	2.16	1.99			
30-34		2.06	2.31	2.21	2.46	3.11	2.85			
35–39		2.70	3.19	3.01	3.24	4.10	3.75			
40-44		3.40	4.06	3.81	3.97	5.01	4.57			
45-49		4.08	4.95	4.61	4.57	5.78	5.25			
50-54		4.69	5.71	5.30	5.16	6.49	5.92			
55-59		5.31	6.42	5.98	5.71	6.99	6.44			
60-64		5.76	6.96	6.50	6.04	7.27	6.75			
65-69		6.15	7.40	6.95	6.36	7.48	7.03			
70-74		6.55	7.50	7.16	6.59	7.30	7.02			
75–79		6.93	7.63	7.39	6.58	7.21	6.98			
80-84		7.20	7.75	7.55	6.12	6.85	6.60			
85–89		6.84	7.76	7.45	6.00	6.72	6.44			
90 and over	• •	5.95	8.08	$\frac{7.38}{}$	4.41	6.03	5.35			
ALL AGES		3.47	4.19	3.91	3.49	4.24	3.93			

It will be seen that in the case of husbands at all ages from 19 upwards, and in the case of wives at all ages from 17 upwards, the average issues in extra-metropolitan areas are much in excess of those in metropolitan areas, the excess amounting in certain cases to as much as 20 or 25 per cent.

Metropolitan and Extra-Metropolitan Average Issues according to Age, 1911.



Graphs Nos. 108 and 109 furnish a representation of the average issues of husbands and wives respectively for Metropolitan and extra-Metropolitan areas of the Commonwealth at the Census of 1911. In each case the figures on the base line denote ages at quinquennial intervals, while those on the left margins denote average issue.

# CHAPTER XX.

# LIFE TABLES.

1. Measures of Rate of Mortality.—(i.) General.—For the purpose of measuring the rates of mortality, experienced by any community, various computations have been employed, which differ materially in the labour involved, on the one hand, and on the other, in the degree to which they suitably measure the phenomenon in question, viz., the rate at which the members of the community are dying. In this connexion it may be noted that, as regards the methods indicated hereunder, it is not correct to describe any of them as erroneous, as is occasionally done. So long as these rates are based upon the actual data, one is quite as correct as another; where they differ is that whilst one may be very suitable for comparisons with similar rates for other communities, others may be less suitable, and others again, quite unsuitable. Thus the crude death rate" which represents the ratio of the deaths of both sexes for a given period to the mean population of both sexes for that period is perfectly correct as long as the number of deaths and the mean population are accurately determined, and the division of the former by the latter is correctly performed. It may also be suitable for some purposes, such, for example, as in a question involving the rate of decrement of a given population at a given time. But it is not suitable for a purpose to which it is very frequently applied, viz., to furnish a basis of comparison in respect of mortality between two communities whose populations are differently constituted in respect of sex, age, and other characteristics, or between two experiences of the same community separated by a lapse of time in which the population has characteristically

It must, however, be borne in mind that all methods of determining rates of mortality, whatever degree of refinement may have been introduced into them, consist in ultimate analysis of the determination of ratios of deaths to population. What is done in the more refined cases is to subdivide both the population and the deaths into like categories according to sex, age, occupation, conjugal condition, etc., and then to determine for each category the ratio of deaths to population. Before proceeding to the methods of life table construction adopted at the present Census, and the data employed thereat, it will be convenient to review briefly the methods which have been adopted under various circumstances for measuring the rate of mortality. The principal of these are six in number, as follows:—

- (a) The computation of a crude rate for the sexes combined.
- (b) The computation of a death rate for each sex separately.
- (c) The determination of the average age at death.
- (d) The calculation of death rate corrected for sex and age.
- (e) The calculation of an index of mortality.
- (f) The construction of a life table.
- (ii.) Crude Rate for Sexes Combined.—Probably the simplest measure of mortality, and that which first suggests itself, is the computation of the proportion of the whole population which has passed away by death during a given period. Where two communities are similarly constituted in respect of sex and age, this crude rate furnishes a useful and simple index to the relative salubrity of their climate and conditions of life. Similarly in a community which had changed little in the sex and age constitution of its population over a series of years, the crude rate would furnish a valuable index to the progress or retrogression of the community from a sanitary point of view. Such conditions, however, rarely exist in practice. Communities usually differ too markedly from each other and from their past selves in respect of sex and age constitution to render comparisons based on crude rates more than rough guides to tendencies which need to be analysed by more refined methods.
- (iii.) Death Rate for each Sex.—Where data in respect both of deaths and population are available for the sexes separately, one of the disadvantages of the crude rate may be overcome by computing two rates, one for each sex. In practically all communities there is a marked difference not only in the physical constitution of the sexes, but also in the conditions under which they live, in the nature of their ordinary occupations, and in the special risks incurred by them. It is consequently not a matter for surprise that there should usually be a very marked difference between the rates of mortality experienced by them. In most civilised communities longevity is more marked amongst females than amongst males, the female death rate being lower than the male at nearly all ages. Apart, therefore, from the question of a comparison with the experience of other communities, it appears desirable, wherever practicable, to segregate males and females for the calculation of mortality rates. To combine them gives a rate which is

applicable to neither the one nor the other. The subdivision, according to sex, however, eliminates one of the advantages possessed by the crude rate, viz., that being a single number, it is readily quoted and easily compared. A rate for each sex is not so manageable. There are two numbers to quote, and if in a comparison with another community, the rate for one sex predominates in the one community, and the rate for the other sex in the other, it is not always easy to draw a conclusion as to relative salubrity.

- (iv.) Average Age at Death.—A method of estimating salubrity which at an early date in the history of vital statistics had considerable vogue was that of determining the average age at death. Off-hand it might be thought that a high average age at death was a sure sign of longevity and consequently of salubrity. A little reflection, however, will shew that everything depends on the ages of the living. For example, a community in which there were no births, arrivals or departures would shew, under normal conditions, an increasing average age at death as it gradually wore down, while a thriving community with a high and increasing birth rate would shew a decreasing average age at death; yet it would be quite possible for the latter to be much more healthy than the former. Here again it may be noted that there is nothing erroneous in computing the average age at death, but an error arises when the conclusion is drawn that a high average age at death necessarily denotes a high degree of salubrity. The method is one which is now practically obsolete as an estimate of salubrity, but, as furnishing, in respect of some disease, the age incidence of death, it may conveniently and legitimately be employed. For example, statistics of the average age at death from phthisis indicate that it is a disease usually fatal in early adult life, while similar statistics of the average age at death from cancer indicate that the victims are usually of more advanced age.
- (v.) Death Rate Corrected for Sex and Age.—Where a number of communities is concerned, and it is desired to effect comparisons between them in respect of mortality, a mode of operation has been devised which, by providing a correcting factor based on age and sex, for application to the ordinary crude rate, retains the simplicity of the crude rate while eliminating some of its inherent defects. This method has been most extensively employed in England, where the Registrar-General of England and Wales has supplied in his annual summaries since 1883, a series of corrected death rates for the principal English towns. The first step in calculating the desired correction factors, is that of computing for each town a "standard death rate." obtain this, the average death rates per annum in age-groups for each sex are determined for England and Wales for the whole of an intercensal period. These death rates on being applied to the sex and age distribution for a town as ascertained at the most recent Census, give the total number of deaths that would have arisen in the town if the average rates for England and Wales had operated therein for a year on a mean population distributed as regards sex and age in the same manner as the population of the town was distributed at the date of the Census. division of this total number of deaths by the total Census population of the town furnishes the "standard death rate" for the town. The ratio of the crude rate for England and Wales for the whole of an intercensal period, to the "standard" death rate of a town, for the terminal Census of the period is the town's "factor for correction" for age and sex contribution, and is applied to the crude rate determined for the town in the ordinary way during the ensuing intercensal period. Since the correction factor for any community is determined once only for each intercensal period, and when determined is applied simply as a multiplier to the crude rate for the community, for any year or other period, it is clear that it furnishes a very convenient means for taking into account the sex and age constitution. Also, if the age groups on which it is based are not too comprehensive, for example, not larger than quinquennial, or at the outside, decennial groups, and if it can safely be assumed that the sex and age distribution of the community does not during the ensuing intercensal period deviate markedly from the Census results, the application of the correction factor supplies a very reliable indication of relative salubrity.
- (vi.) Index of Mortality.—The method of procedure outlined in (v.) consists in the main in (a) the computation of a normal series of death rates for sex and age; (b) the application of such a series successively to the actual sex and age distributions of the various communities under consideration; (c) the calculation of the crude rate resulting from the application mentioned in (b); and (d) the computation from (c) of a correction factor. Another method which is much in vogue, and which has been approved by the International Statistical Institute, is in some respects the converse of this. It consists in (a) the determination or selection of a population norm, i.e., of a normal scale of distribution of population according to sex and age; (b) the computation for the community under review of death rates for sex and age-groups corresponding to those adopted for the population norm; (c) the application of the rates in (b) to the norm in (a); and (d) the calculation of the crude rate resulting from the application mentioned in (c). The crude rate so obtained is usually called the "index of mortality," or, in the case of the Registrar General of England and Wales, the "rate in standard population." Where the data for computing the rates of mortality for the appropriate sex and age-groups are readily available, this method furnishes one of the most satisfactory indications of relative salubrity that have yet been described. In essence it consists in computing for a normal population the crude death rate that would arise therein from the operation of the death rates for sex and age-groups ascertained to have operated for the community under review during a given period. From another point of view it is a weighted mean of the death rates for sex and age-groups of the community under review, the weights employed being the appropriate portions of the population

norm. The subject of population norms and their application was discussed in a paper by G. H. Knibbs and C. H. Wickens, presented to the Fifteenth International Congress on Hygiene and Demography, held at Washington, September 23–28, 1912. The paper was published in Volume VI. of the Transactions of the Congress, pp. 352 et seq. The matter is also dealt with in Appendix A hereto. The principal difficulty in connext with the computation of the index of mortality for any posteroral period is that of distributing the population of the sequence of mortality for any posteroral period is that of distributing the population of the sequence of mortality for any posteroral period is that of distributing the population of the sequence of mortality for any posteroral period is that of distributing the population of the sequence of the sequence of the sequence o of mortality for any postcensal period is that of distributing the population of any community for such period according to sex and age. An assumption usually made is that the scale of distribution is the same as that disclosed at the preceding Census. For some communities such an assumption involves little error, in others the discrepancy may be large, but there are no simple means for obviating it. In any event the indications of relative salubrity furnished by such an index or by the corrected rates dealt with in sub-section (v.) are much more reliable than can be got by crude rates, rates for sexes, or average ages at death. It may be noted here that although the only characteristics which are dealt with in the ordinary course in computing correcting factors or indices of mortality are sex and age, these are by no means the only ones whose neglect may vitiate conclusions as to relative salubrity. For example, the effect of race on death rate has not yet been definitely determined, but there is little doubt that the variation with age of the death rate amongst European races on the one hand, and coloured races on the other, is essentially different. To institute comparisons, therefore, between mixed populations such as those of the United States, the Union of South Africa, and British India, where European and coloured races are associated in such markedly different proportions, it is not sufficient merely to allow for sex and age, race also should be taken into account.

- (vii.) Life Tables.—In connexion with the measures of mortality dealt with in subsections (v.) and (vi.) above, it may be noted that from one point of view each consists in the determination of ratios of deaths to population for sex and age-groups, and the subsequent computation of a weighted mean death rate. From another point of view each consists of the computation of a series of death rates for one population, and the application thereof to another population, the correction factor method involving the computation of standard death rates and the application thereof to variable population distributions while the index of mortality method involves the computation of death rates in sex and age-groups for populations varying in sex and age distribution, and the application thereof to a population norm, or population of standard distribution. A further method for measuring mortality is that of constructing a Life Table for the population in question. Here again the main element is the ratio of deaths to population for sex and age-groups, but in this case there is no adoption of an arbitrary standard either of death rates or of population distribution. What is done is to arbitrarily select any number as the number of children born, and by the successive application thereto of death rates for sex and age derived from the experience of the community under observation, to compute the number who will attain each successive age, on the supposition that the computed rates for each age operate at the appropriate ages throughout the lifetime of the children so selected. A table so constructed, however, shewing the number of each sex surviving at each age out of a given number born, is no more convenient for the purposes of quotation or of ready comparison with other experiences than is the original series of death rates for sex and age on which the table of survivors has been based. The latter, however, presents, in a convenient form, data for the computation of a measure of mortality which is convenient for the purposes of both quotation and comparison. The measure referred to is what is generally known as the "expectation of life," or the "average future lifetime." Of these expressions the former is the more generally used, but the latter expresses the nature of the function in the better way. What is represented by the expectation of life at any age, is the average future life time of the persons who reach that age, and are subject at succeeding ages to the rates of mortality deduced from the experience under review. The expectation of life at age 0, consequently, since it represents the average quantity of life that will be lived by each person born, furnishes as suitable a measure of relative salubrity as could be devised, and one which is entirely free from the introduction of an arbitrary standard whether of death rates or population distribution. necessarily relates, however, only to a completed period, and consequently will not serve the purpose of providing comparative results for a current period. For this latter purpose the correction factor and the index of mortality furnish the best results.
- 2. Life Tables.—(i.) General.—It is not proposed in the present chapter to enter at all fully into either the theory or the practice of the construction and graduation of Life Tables in general, but it appears desirable to review briefly the general principles involved, and to indicate the sources of data and the methods employed in connexion with some of the more important existing tables, more particularly those relating to the general population of a country or some particular portion of it. In a general way mortality investigations may be divided into two classes, viz., (a) those concerned with selected data, and (b) those relating to the general These may be further classed as follows: population.
  - (a) Investigations of selected data
    - 1.—Life assurance experience.

    - 2.—Annuitants' experience.
      3.—Benefit societies' experience.
    - 4.—Public or other service experience.
  - (b) Investigations of general population-
    - 1.—National experience.
    - 2.—Local experience.

All such investigations are usually capable of subdivision, one of the most important instances being that of distinguishing between males and females. Other heads of subdivision are frequently of considerable value, such, for example, as duration of assurance and class of policy in the case of life assurance experience, race and conjugal condition in the case of a national experience, and elevation, situation, and density of population in the case of a local experience.

(ii.).—Selected Data.—For special purposes, such for example, as the computation of appropriate premiums and the valuation of liabilities under contracts issued by life assurance, annuity and benefit societies, it is desirable that the life tables employed should, if practicable, be those which have been deduced from the experience of the class concerned, that is, from the experience of the policyholders, the annuitants or the benefit members as the case may be. In all such cases what is required is a means of gauging the future for financial purposes, and evidently the best guide to the future experience of any body of persons is an appropriate review of the past experience of a body of persons who have been, as nearly as possible, similarly circumstanced. Such tables are becoming more and more elaborate, and extensive as appropriate records are accumulated, more especially in the field of life assurance which has made such colossal advances in the volume and range of its business during the last half century. In this connexion it will be sufficient to instance the British offices' Mortality Investigation of the experience of assured lives and annuitants during the period of 30 years from 1863 to 1893, the results of which constitute at present the standard tables for life assurance and annuity purposes in the United Kingdom, and also in Australia. These tables were based on the assured lives and annuitants that came under observation during the 30 years, whether as policyholders or annuitants with contracts in force at the commencement of the period or as entrants during its currency, and the deaths which arose therefrom during the period. The data were analysed in detail for the sexes separately, for various classes of policyholders, and for duration of contract as well as for age.

In the case of benefit societies, as there is a considerable amount of difference in the methods of administration in different societies as well as in the constitution of the societies in respect of membership, the adoption of standard tables is not always practicable.

One of the most complete investigations of the experience of a benefit society is that which was carried out by the Manchester Unity Friendly Society, Independent Order of Oddfellows, in connexion with their male experience in the United Kingdom for the five years 1893–1897.

In this investigation, which naturally was largely concerned with the question of sickness, the mortality experience occupied a relatively minor, but still very prominent place. For mortality purposes the data were subdivided into three area groups, and those for each area group were further subdivided into urban and rural data.

As regards widows' funds, pension schemes, superannuation schemes, etc., there is usually so much difference in detail, frequently in important matters, that it would be difficult to obtain a supply of data sufficiently homogeneous to admit of the construction of a standard table that would be of practical value. In such cases mortality is only one of many objects of inquiry, and it is usually desirable, where practicable, in dealing with any such fund or scheme to use the experience of the scheme itself rather than a standard table.

(iii.) Investigations Concerning General Population.—In all investigations involving selected data, such as those outlined in subsection (ii.) above, the individual lives concerned are traced from the time they come under observation until their exit therefrom by death, withdrawal, or the close of the observations. Further, there are usually more or less extensive inquiries made in each case to ensure accuracy in the statement of age. Where, however, the subject of investigation is the rate of mortality amongst the general population of a country or of a locality for a given period, the individual method is quite impracticable, and a method has to be devised which deals with population in bulk. There are also not the same facilities for checking the information furnished in respect of age.

In such cases, the information is mainly supplied from one or other or more usually from both of two distinct sources. One of these sources is a population Census taken according to sex and age for one or more epochs, and the other is the registration of deaths according to sex and age for a given period. To construct a satisfactory life table from Census results alone, or from registration returns alone would require a much greater degree of uniformity for a series of years in the constitution of the population in respect of number, sex and age than is in practice obtainable. Notwithstanding the inherent difficulty of the problem, there are two or three celebrated cases in which such tables have been compiled.

In this connexion it is of interest to note that statistics of deaths, or more strictly of burials, were in existence in detailed form, long before the corresponding figures in respect of population were available. On the basis of the burial records of Breslau, Dr. Halley constructed in 1693 what is believed to be the world's first life table, while on the burial records of the parish of All Saints, Northampton, Dr. Price constructed his celebrated Northampton table. Neither table furnished a reliable index to the rate of mortality, as neither was based on a population which had remained unchanged for a long period, and the adjustments that could be made for this want of uniformity were too insecurely grounded to furnish satisfactory results.

On the other hand the construction of life tables based mainly on Census returns has been a feature of the Census reports of India from 1881 onwards. These, although constructed with great ingenuity and with close attention to the conditions of life of the several communities for the respective periods of observation, cannot be regarded as furnishing so satisfactory a series of results as would have been obtained if death registrations as well as Census records had been available.

In view of the fact which has been stated in an earlier part of this chapter, that all measures of mortality are based on ratios of deaths to population, it may be thought that the cases here cited of the construction of life tables from deaths alone, and from Census results alone, are exceptions to the general rule. This, however, is not so. In both cases, although one of the two items is wanting in the original data, it is, in effect, supplied by a process of calculation before the measure of mortality is actually obtained. Thus, both Halley and Price do what is equivalent to constructing, from the death returns, the populations from which they had been derived, while the Indian Census method proceeds largely on the method of estimating the deaths at various ages from the age results for successive censuses.

In the more usual cases in which both Census results and death registrations are available, there are two leading methods of dealing with the matter, besides others which may be regarded According to one of these methods the results of a single Census are taken for determining the population basis, and the mean annual deaths at each age for a period extending to an equal distance on either side of the Census date are taken as furnishing the death According to the second method, two Censuses are taken for determining the population basis, and the death registrations for the intervening period furnish the death experi-Where rates of mortality are changing rapidly, and a Census is taken only once in ten years, it is held by some that although the life tables based on the two Censuses and the deaths for the intervening period furnish correct average results for the decennial period, these results may be regarded as relating approximately to the middle of the decennial period, and hence, by the time the table is constructed, as being at least seven or eight years old. On the other hand, it is urged that with a single Census and a relatively short period on either side of it for death experience, a life table could be available within two or three years of the epoch to which it approxi-Against these contentions there are two objections. Firstly, for population results a period terminated at each end by a Census is more accurately defined than one in which the Census occupies a middle position; secondly, a period of ten years furnishes a greater range for the elimination of accidental fluctuations due to epidemics or other causes, than is furnished by a period of two, three or four years surrounding a Census. A consideration of the circumstances indicates that for a permanent record of the progress of a community in the matter of mortality, a series of life tables, each based on two Censuses and the intervening deaths, gives the best results, but that the single Census method is useful as furnishing preliminary information of the trend of events, and also in those cases in which so large a range of death data as that relating to a whole intercensal period, is not available.

It may be pointed out that what is actually done in all these cases, is to determine, or rather to estimate for a given period the number of years of human life that have been spent by the community at each age, and to ascertain the number of deaths that have occurred at each age during the same period, the ratio of the one to the other giving a basis for the construction of a life table. Where one Census only is used, and the death returns for a period of say a year on either side of the date of the Census, the assumption which is frequently made is that the total number of years of life experienced in the two-year period is twice the Census total, and that the sex and age distribution of this number is identical with that of the Census. This assumption is simply applied in practice either by multiplying the Census data by two throughout and dividing by it the aggregate deaths at each age for the period, or more usually by dividing the average number of deaths per annum at each age by the actual Census figures. These two processes, of course, give the same result, since in any fraction the multiplication of the denominator by a given number produces the same result as the division of the numerator by that number.

It is necessary to emphasise the fact that in these cases the Census or Censuses do not actually supply the population basis, but rather furnish a scale of distribution according to age by means of which the life experience for the period of observation may be distributed according to age, and may thus be rendered comparable with the death experience for the same period. The necessity for this is shewn by the fact that a great deal of misconception exists in connexion with the matter, and statements are occasionally made, even by experts, which convey the impression that, in the construction of these tables, deaths are divided by populations to which they are only remotely related. For example, in a paper "On the construction of Mortality Tables from Census Returns and Records of Deaths," by Mr. George King, F.I.A., F.F.A., published in the Journal of the Institute of Actuaries, Vol. XLII., p. 225, the author, in referring to the experience of assurance and annuity societies, says: "We therefore have something approaching to accuracy, and the deaths take place among the lives actually observed, there being close relationship between those who are exposed to risk and those who die. . . . With mortality tables formed from Census returns and death registers the case is different. . . Many of the recorded deaths are not those of persons included in the enumerations. For instance, the English Life Table, No. 2, was based on the population of England and Wales enumerated at the Census of 6th June, 1841, and the deaths recorded in the seven years, 1838 to 1844; so that many of the deaths took place before the date of the Census, and could not have been deaths among the population counted." It is quite true, of course, that the deaths before the Census were not

deaths among the population actually counted, but it is also true that they were deaths amongst the population on which the life table was based. As indicated above, this latter is represented by the total number of years of life experienced in the community during the seven years 1838 to 1844, and the service which the Census performs is that of enabling an estimate to be made of the total volume of this experience and of its distribution according to age. The assumption made in this case is that the total volume is seven times the Census total, and that the distribution of this volume according to age is in accordance with that disclosed by the Census. The process is analogous to estimating the composition of a solid by means of the careful measurement in detail of a vertical cross section made at the middle point of its length. The assumptions to be made, and the validity of such assumptions will vary, of course, with each particular case, but the object aimed at in every case is the same, viz., the estimate in appropriate groups of the life experience for the same period as that for which the death experience is available, and it is only on this basis that the use of Census figures for life table purposes has an interpretable result.

The case of a single Census with an equal range of death experience on either side of it, and that of two Censuses with the intermediate range of death experience have been mentioned as those which usually arise in practice. There is, of course, no reason except those of expediency and appropriateness to the object in view why these should not be varied to any desired extent, and an example of such variation occurs in the case of the English Life Table, No. 3, which was based on the death experience of the 17 years, 1838 to 1854, and the results of the Censuses of 1841 and 1851. It was, in a sense, a combination of the single and dual Census methods.

What has been said in the present sub-section relates equally to National and Local Tables, the main difference between which is the geographical distribution of the experience.

- Australian Life Tables.—(i.). General.—Until the Census of 1911, in connexion with which numerous and extensive general life tables have been compiled, the construction of such tables in Australia has in only two previous instances, been carried out by a Government department, one of these being the construction of life tables for New South Wales in connexion with the Census of 5th April, 1891, and the other the construction of a similar table for Western Australia in connexion with the Census of 31st March, 1901. Several other investigations of the mortality experience of an Australian general population have, however, taken place, and have formed the subject of papers read before actuarial and kindred societies, but it was not until the present occasion that complete tables for the whole of Australia were compiled. addition to the investigation of the mortality of the general population, there have been several investigations of selected data, of which the more important are: (a) Assurance Experience, (b) Friendly Societies' Experience, and (c) Public Service Experience. A brief outline of the more important tables constructed from Australian data is furnished in the succeeding subsections.
- (ii.) New South Wales, 1856–1866.—What is believed to be the first life table based on Australian experience was constructed by Mr. M. B. Pell, B.A., Professor of Mathematics in the University of Sydney. This table was compiled in 1867 on the basis of the death records of the State of New South Wales for the eleven years, 1856 to 1866 inclusive, and the results of the Censuses of 1856 and 1861. The results of the investigation and deductions drawn therefrom were contained in a paper read before the Royal Society of New South Wales on 6th November, 1867, and published in Volume I., p. 66, of the Transactions of the Society. Death rates are given in the paper for males and females separately, mainly in quinquennial age-groups, but the principal life table results are furnished only for the sexes in combination. No information is given concerning the methods of construction adopted, and nothing is said concerning the graduation, if any, applied to the data.
- (iii.) New South Wales, 1860-75.—In or about the year 1877, Professor Pell constructed a further table based on the deaths registered in New South Wales during the 16 years, 1860 to 1875 inclusive, and the Censuses of 1861 and 1871, while in the case of the mortality of children under the age of 5, use was made of the birth registrations. This table was published in pamphlet form, and was afterwards included in a paper read before the Institute of Actuaries, London, on 6th January, 1879, and published in Volume XXI. of the Journal of the Institute, p. 257. The methods adopted in constructing the table and graduating the results are very fully shewn in the paper, which, in addition to the values of the elementary functions for each sex separately, furnishes also commutation columns and annuity and assurance values for each sex at 4 per cent. For ages above 75 the values were merged into those of the English Life Table, No. 3, modified by increasing the death rates by a small percentage. The methods of construction and graduation consisted in the computation of death-rates for quinquennial age-groups, and the interpolation for single ages by means of Lagrange's Theorem.
- (iv.) Victoria, 1871.—On the 27th March, 1882, a paper was read before the Institute of Actuaries, London, by Mr. A. F. Burridge, F. I. A., which contained a life table for the State of Victoria, based on the death experience of 1871, the Census taken in that year and the births registered during the six years, 1866 to 1871 inclusive. The paper was published in the Journal of the Institute, Volume XXIII., p. 309. The method of construction was by means of a graphic process similar to that used by Milne in the construction of the Carlisle Table, the probabilities of surviving a year at each age, when determined, being further graphically graduated. The results are given for males and females separately.

The terminal values of the tables were obtained by taking for males from age 80 onwards the corresponding values from the English Life Tables No. 1—Males, and for females from 70 onwards the values for females from the No. 1 table taken one year younger.

- (v.). New South Wales, Victoria, Queensland, 1870-1881.—A further paper "On the rates of mortality in Australia" was read by Mr. Burridge before the Institute of Actuaries on the 25th February, 1884, and was published in the Journal of the Institute, Volume XXIV., p. 333. This paper contains life tables based on the death experience of the twelve years, 1870 to 1881 inclusive, the results of the Censuses of 1871 and 1881, and the birth registrations for the twelve years, 1870 to 1881 inclusive. A life table for Victorian males is given separately, as well as tables for each sex for the States of New South Wales, Victoria and Queensland in combination. As in the case of the table mentioned in (iv.) above, the method of construction was based upon the Milne graphic method, supplemented by a graphic graduation of the death rates derived therefrom. For ages above 80 the values employed were obtained by deducting a small percentage from the corresponding death rates shewn by Farr's Healthy English Table.
- (vi.) New South Wales, 1870-81; Victoria, 1861-87; Queensland, 1870-81; Tasmania, 1876-85.—In a paper read before the Insurance Institute of Victoria, Melbourne, on the 10th July, 1889, and published in the Australasian Insurance and Banking Record, Volume 13, p. 618, Mr. T. W. Bremner, F.F.A., A.I.A., presented a series of tables which he had constructed for several of the Australian States. The tables for New South Wales and Queensland cover the 12 years 1870-81, while for Victoria two tables were constructed, one for the 20 years, 1861-80, the other for the 7 years, 1881-87. In addition a table for Tasmania covering the 10 years, 1876-85, was also constructed. In all cases the tables were for the sexes combined, and related only to the period of life from age 15 to age 70. The methods of construction and graduation consisted in computing death rates per 1000 of population for various age-groups, and in graduating and interpolating for single ages by the graphic method.
- (vii.) New South Wales and Victoria, 1881-91.—On the 14th June, 1893, a paper was read in Sydney before the Insurance Institute of New South Wales, by Mr. W. B. Dovey, F.F.A., which contained life tables for males and females separately for the States of New South Wales and Victoria combined, the period covered by the investigation being the eleven years, 1881 to 1891 inclusive. The data employed were the death experience for the eleven years mentioned, the results of the Censuses of 1881 and 1891, and the births registered during the ten years, 1881-90. In the construction of the tables, Milne's graphic method was employed, the death rates deduced therefrom being subsequently graphically graduated. For ages above 70 the table was merged into the English Life Table No. 3, taking the probabilities for one year younger in the case of females, and at the same age for males. This paper was published in the Australasian Insurance and Banking Record, Volume 17, p. 832.
- (viii.) New South Wales and Victoria, 1881-90.—On the 11th July, 1894, a further series of life tables for New South Wales and Victoria was presented to the Insurance Institute of New South Wales in a paper by Mr. A. Duckworth, which was published in the Australasian Insurance and Banking Record, Volume 18, p. 656. These tables were based on the death experience for the decennium 1881-90, the Census results of 1881 and 1891, and the birth registrations for the 9 years, 1881-1889. In constructing the tables, death-rates were computed for age-groups, and then graphically graduated. For ages above 80 the rates of mortality employed were those given for males in Dr. Farr's Healthy Districts Table, with a percentage added. From the paper it appears that separate tables for males and females for each of the States were constructed, but the published results relate only to the combined experience of males and females for the two States combined, supplemented by further tables for Melbourne and suburbs, and for Sydney and suburbs, also for the sexes combined. For each of these three tables annuity values on a 4 per cent. basis were compiled and published.
- (ix.) New South Wales, 1890-92.—The first life tables officially compiled from Australian data on the basis of Census results and death registrations, were those constructed under the direction of Mr. T. A. Coghlan, Government Statistician of New South Wales, in connexion with the Census of that State taken in 1891. These tables, one for males and the other for females, were based upon the death experience for the two years from 1st April, 1890, to 31st March, 1892, and the results of the Census taken for the 5th April, 1891. The tables were published in the Statistician's Report on the eleventh Census of New South Wales, issued 16th August, 1894 (see pp. 146-153), but no statement is made of the methods employed in obtaining the unadjusted death-rates, though it is stated that these results were graduated by the employment of Woolhouse's method. It is also not clear from the report by what means the rates for infantile ages were computed, but in the absence of any reference to the employment of birth statistics in this connexion it appears probable that the Census results were used throughout. The calculations were made up to age 100, but results were not published beyond age 90, as the number of persons over that age was considered too small to furnish the basis for life table calculations.
- (x.) New South Wales and Victoria, 1889-93.—On 25th March, 1901, a paper "On the Rates of Mortality in New South Wales and Victoria," by Messrs. E. M. Moors, M.A., F.I.A., and W. R. Day, F.I.A., was read before the Institute of Actuaries, London, and was published in the Journal of the Institute, Vol. XXXVI., p. 151. This paper contained male and female

life tables for New South Wales and Victoria combined, based upon the death experience for the five years, 1889 to 1893 inclusive, the results of the Census of 5th April, 1891, the birth registrations for each of the 9 years, 1884-1892, and the records of migration for each of the 5 years, 1889 to 1893. In the main, the construction of the tables was carried out on the lines of Milne's graphic method, a feature of the process being the use of a specially prepared pine table, 5-feet by 3-feet, cross-ruled into half-inch squares. The numbers dying at each age in the life tables so deduced, were then graduated by Woolhouse's method. Included in the published tables are annuity values at  $3\frac{1}{2}$  per cent. for males and females separately.

- (xi.) Western Australia, 1899-1902.—The second series of official life tables constructed from Australian Census and registration data, were compiled under the direction of Mr. M. A. C. Fraser, Government Statistician of Western Australia, in connexion with the Census of 1901. This investigation was based on the death registrations for the three years from 1st October, 1899, to 30th September, 1902, the results of the Census for the 31st March, 1901, and the birth registrations for the seven years from 1st April, 1895, to 31st March, 1902. Separate compilations were made for males and females. Death rates for ages 5 and upwards were computed by making each age the centre of a group of 5, and assuming that the rate deduced for each such age-group was that applicable to its central age. The numbers dying at each age in the life tables so obtained were then graduated by Woolhouse's method. Owing to the paucity of data for the higher ages, the probabilities of surviving a year at ages 72 and upwards for males, and at ages 64 and upwards for females, were taken from the tables of Messrs. Moors and Day, referred to in subsection (x.) above. The results of the investigation were published in Volume I., p. 208, of the Report on the Seventh\*Census of Western Australia, 1901, which was issued on the 29th January, 1904.
- (xii.) Australia, 1881-90, 1891-1900, 1901-10.—An examination of the tables enumerated in the foregoing sub-sections discloses many features, apart from the actual processes of construction and graduation which render them unsuitable for purposes of a comparison made with the object of ascertaining the improvement in respect of mortality, which has been experienced either in Australia as a whole or in its component States. One of the most serious objections on this score is, that no table shews the particulars for the whole of Australia. some of the tables relate to the sexes separately, others furnish particulars only for the sexes combined, and whilst some relate to single States, others furnish tables only for States in combination, with the added complication that such combinations are not the same in all cases. In addition to these drawbacks there are cases in which the tables relate to a portion only of In view of these circumstances it was considered desirable in undertaking the construction of life tables for the decennium 1901-10, in connexion with the Census of 1911, to compile also similar tables for the decennia 1881-90 and 1891-1900, thus furnishing suitable bases of comparison with the results obtained for 1901-10. A table for males and one for females were accordingly constructed for each of the three decennia, for the Commonwealth as a whole, and for each of its component States, making in all a total of 42 separate tables. data employed in the preparation of these tables, and of the methods of construction and graduation adopted are furnished in later sections of the present Chapter.
- (xiii.) Assurance Experience.—The only extensive investigations of the mortality of assured lives in Australia are those which, on three different occasions, have been undertaken by the Australian Mutual Provident Life Assurance Society. The first of these investigations which was carried out by Mr. M. A. Black, F.I.A., the Actuary to the Society, was completed and published on the 30th December, 1881. It related to the society's experience for the period of about 30 years from 21st February, 1849, to 31st December, 1878, and the tables deduced therefrom were in respect of males and females combined. A similar investigation for the period of about 40 years from 21st February, 1849, to 31st December, 1888, was carried out by Mr. R. Teece, F.I.A., F.F.A., the actuary to the Society, the results, which related to males and females combined, being published on 31st August, 1891. The resulting general mortality table was separately graduated by Woolhouse's method, and by the graphic method. A further investigation for the period of about 55 years from 21st February, 1849, to 31st December, 1903, was carried out by the same actuary, the results being published on 19th July, 1911. In this case separate tables were constructed for males and females, and a distinction was made between whole life and endowment assurance business, and between healthy lives and total lives (including those with loaded premiums). The whole life assurance tables were graduated by Woolhouse's method, the endowment assurance tables by the graphic method. In each case the results of the investigation were fully set forth in a report published by the Society.
- (xiv.) Friendly Societies' Experience.—Three important investigations of the mortality experience of friendly societies have been made in Australia, dealing respectively with the States of South Australia, New South Wales and Victoria. In each case the investigation was a Government undertaking, the work being carried out by the respective Government Actuaries for friendly societies, and each comprised an extensive analysis of sickness as well as mortality experience. The earliest of these investigations was that carried out by Mr. H. Dillon Gouge, Public Actuary, which covered the male experience of all registered friendly societies in South Australia for the 10 years 1895-1904. The mortality table was graduated by means of Spencer's 21-term formula, and for age 80 and upwards a modification of the values from the Institute of Actuaries  $\mathbf{H}^{\mathbf{M}}$  table was employed. The tables which, in a complete form, were published on 21st June, 1909, contain monetary values based on interest at  $3\frac{1}{2}$  per cent. per annum.

The second investigation of this nature was that concerning the male experience of the registered Friendly Societies of New South Wales for the nine years, 1900-1908. This was carried out by Mr. John B. Trivett, F.S.S., F.R.A.S., in his capacity as Actuary of Friendly Societies, the results being published in 1910. The data were classified into mining and non-mining experience and separate tables were published for each of these, as well as for the two experiences combined. The central death-rates deduced, were graduated by Spencer's 21-term formula, the probabilities obtained thereform being retained for ages 18 to 69. For ages 80 to 102 values of the probability of dying in a year were taken from the British Offices O<sup>M</sup> table, and those for ages 70 to 80 were then supplied by interpolation between the two series. The tables contain monetary values based on interest at the rates of  $3\frac{1}{2}$  and 4 per cent. per annum. The third Friendly Societies' investigation was that made by Mr. A. M. Laughton, F.I.A., F.F.A., Government Actuary for Friendly Societies in Victoria. For the purpose of this investigation the male experience of three of the largest friendly societies operating in Victoria was selected, the period of observation being the five years, 1903-1907. In selecting the data for tabulation, the experience of lodges which had been in existence for less than five years was excluded, the experience of the remaining lodges being tabulated and published under the head of "Whole Experience," to distinguish it from the results of a further analysis which involves the elimination of all lodges containing a large number of members engaged in the mining industry. The experience obtained from this latter elimination was tabulated under the head of "Non-mining." The Mining experience was not separately published. The whole of the results are contained in a report published in June, 1912. The mortality experience was graduated by Spencer's 21-term formula, the rate of mortality obtained therefrom being retained in the final tables for ages 18 to 69 inclusive. These in the "Whole Experience" table were succeeded for ages 70 to 95 by values from Messrs. Moors and Day's table, mentioned in (x.) above, and for ages 96 to 100 by approximations from Watson's Manchester Unity Experience, 1893-97.—(Whole Society Table). In the case of the "Non-mining" experience, a similar course was followed, with the exception that for ages 70 to 80 inclusive the values employed were taken from the O<sup>M (5)</sup> Table. The monetary tables published comprise commutation columns and annuity and assurance values based on interest at the rates of  $\bar{3}$ ,  $3\frac{1}{2}$  and 4 per cent.

- (xv.) Public Service Experience.—There have been in Australia two important investigations of the mortality experience of members of the public service carried out in connexion with proposals to establish superannuation and widows' and orphans' funds, of which the results have been published. The first of these was an investigation by the Commonwealth Statistician (Mr. G. H. Knibbs, C.M.G., F.S.S., etc.,) concerning the experience of the Commonwealth Public Service for the six years, 1903 to 1908. Rates of mortality amongst male members of the service were computed and graphically graduated for the Administrative, Professional, and Clerical divisions in one group, and the General Division in another, the range of ages being 17 to 65 in the former, and 14 to 65 in the latter group. The mortality rates so deduced were used in conjunction with other rates in computing the values of various superannuation and other benefits, the rate of interest adopted being  $3\frac{1}{2}$  per cent. The results of this investigation were contained in a report to the Minister for Home Affairs, dated 19th October, 1910. The second of the investigations mentioned was made by a committee of actuaries (Messrs. E. M. Moors, M.A., F.I.A.; T. W. Bremner, F.F.A., A.I.A.; J. B. Trivett, F.R.A.S., F.S.S.) in connexion with superannuation proposals for the State of New South Wales. The experience covered was that of the New South Wales Public Service for the fifteen years, 1896 to 1910 inclusive, and was divided into three groups: (a) Males, General Division; (b) Males, other Divisions; and (c) Females. In computing monetary tables for the purposes of the investigation interest at  $3\frac{1}{2}$  per cent. was used, but after a review of the data the committee decided not to employ the rates deduced from the actual experience, but employed instead the British Offices' O<sup>M</sup> rates of mortality with 25 per cent. off.
- 4. Australian Life Tables at Census of 1911.—(i.) Data Employed.—For the purposes connected with the construction of the series of Australian Life Tables for the three decennia, 1881-90, 1891-1900, and 1901-10, the requisite data involved on the one hand the deaths of each sex registered in each of the States for the 30 years, 1881 to 1910 inclusive, classified according to age, and on the other an estimate for the same period of the life experience from which these deaths had arisen, such life experience being also classified according to age.
- (a) Death Statistics.—The principal source of the statistics of deaths used in the construction of the life tables was for the earlier years the Statistical Registers and Reports on Vital Statistics published by the several States, and for the later years the Demography Bulletins compiled and published by the Commonwealth Bureau of Census and Statistics. For the decennia 1881-90 and 1891-1900, the data for two of the States, viz., Victoria and Queensland, were somewhat defective owing to the fact that the final age-group comprised all ages from 80 upwards. In the other States, as also in these two States for ages prior to 80, the data were available in single ages from 0 to 4 inclusive, and thence forward in quinquennial age-groups. In all the States there was a small proportion of cases of deaths of persons of unspecified age. Such deaths represented about 4 per 1000 of total for the decennium 1881-90, about 1.7 per 1000 for 1891-1900, and about 1.25 per 1000 for 1901-10. For each sex in each State the number unspecified was distributed over the various age-groups in proportion to the number specified. The defect mentioned above in the case of Victoria and Queensland was remedied

by computing in the case of New South Wales for the same decennia the death-rates for each of the quinquennial age-groups involved, and by so adjusting these rates proportionately that when applied to the appropriate life experience of the two States for the ages in question they reproduced the aggregate number of deaths in each case. In other words it was assumed that in Victoria, and Queensland, the death-rates for the several quinquennial age-groups involved had to one another the same ratios as the corresponding rates in the case of New South Wales. These computations were made separately for each sex in each decennium.

In certain cases data which were not available in the published statistics for Western Australia and the Northern Territory were kindly specially prepared by the Registrars-General of Western Australia and South Australia respectively from their death registers.

The death basis of the several life tables is indicated in the following table, which gives the number of deaths of each sex in each State, and in the Commonwealth as a whole, for each of the three decennia, a computation being added to shew the proportion in each case contributed by each State to the aggregate death experience of the Commonwealth. In all the tables contained in this Chapter, New South Wales includes the Federal Territory, and South Australia includes the Northern Territory.

# Deaths in Australia, 1881 to 1910.

	Males.	FEMALES.
STATE.	1881-90. 1891-1900 1901-10.	1881–90. 1891-1900 1901–10.

### NUMBER.

Victoria Queensland South Australia	•••	• •	• • • • • • • • • • • • • • • • • • • •	$\begin{array}{r} 86,915 \\ 35,032 \\ 22,807 \end{array}$	$\begin{array}{c} 92,975 \\ 35,335 \\ 22,812 \end{array}$	$\begin{array}{ c c c c }\hline 84,411\\ 35,678\\ 21,709\\ \hline\end{array}$	$\begin{array}{c} 64,544 \\ 18,739 \\ 18,170 \end{array}$	70,409 20,448 18,906	$\begin{array}{c} 67,044 \\ 21,279 \\ 17,825 \end{array}$
Western Australia Tasmania		• •	• • •	4,025 11,785	11,941 11,609	17,840 10,744	2,024 8,391	5,494 8,829	10,154 9,018
Commonweal	ľН			240,940	264,736	262,094	169,052	188,607	192,519

## PROPORTION PER CENT.

New South Wales Victoria Queensland South Australia Western Australia Tasmania		••	% 33.36 36.07 14.54 9.47 1.67 4.89	34.02 $35.12$ $13.35$ $8.62$ $4.51$ $4.38$	% 34.99 32.21 13.61 8.28 6.81 4.10	33.83 38.18 11.08 10.75 1.20 4.96	34.21 37.33 10.84 10.03 2.91 4.68	% 34.91 34.83 11.05 9.26 5.27 4.68
COMMONWEALTH	Ī.	• •	 100.00	100.00	100.00	100.00	100.00	100.00

Two of the States, namely, New South Wales and Western Australia, contributed in a larger proportion to the Commonwealth totals in 1901-10 than in 1881-90 in the cases of both male and female deaths, while the other four States contributed in both sexes in a smaller proportion in 1901-10 than in 1881-90. As will be seen later, these higher proportions for New South Wales and Western Australia were mainly due to the more marked increases in the populations of these States, while the diminution in proportion in the case of Queensland accompanying a heavy increase in population was due in great measure to a marked improvement in the rate of mortality experienced in that State in the later as compared with the earlier decennia.

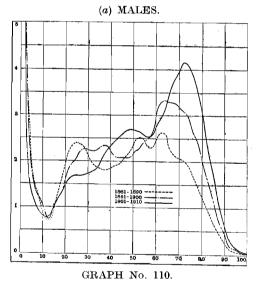
The succeeding table furnishes for each of the decennia for the Commonwealth as a whole, the number of deaths of each sex in each age-group after the distribution of those in respect of which the particulars as to ages at death were either absent or insufficient;—

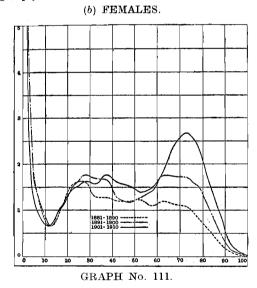
Commonwealth.—Deaths in Age-Groups, 1881 to 1910.							
	Commonwealth -	_Doothe	in	A go_Groung	1991	ŧο	1010

						MALES.	and the second	FEMALES.			
A	SE LAST	Birth	DAY.		1881-90.	1891-1900	190110.	1881-90.	1891-1900	. 1901–10	
0					63,278	63,447	52,000	52,709	51.781	41,364	
1					13,980	12,513	8,691	13,017	11,381	7,858	
<b>2</b>					4,956	4,463	3,167	4,510	4,155	2,884	
3					3,242	2,934	2,045	3,034	2,842	1,856	
4				• •	2,544	2,272	1,428	2,314	2,158	1,420	
5-9			• •		6,556	6,658	5,066	5,892	6,123	4,496	
0-14	• •	• •			3,897	4,272	4,108	3,507	3,668	3,614	
5-19					7,254	6,328	6,169	5,524	5,392	5,521	
024	• •				11,386	9,478	8,119	7,781	7,512	7,219	
5-29	• •				11,518	11,143	8,487	8,019	8,677	8,024	
0-34			• •		9,664	11,151	8,983	6,535	8,453	7,933	
5-39	• •				9,064	11,557	10,788	6,345	8,151	8,672	
0-44					9,542	10,546	12,314	6,007	6,412	8,070	
5-49					10,793	10,457	13,346	5,936	5,929	7,617	
0-54					12,456	11,501	13,149	6,053	6,329	7,076	
5-59	• •				11,709	12,946	12,925	5,575	7,099	7,410	
0-64	• •				12,882	16,242	14,994	5,885	8,624	9,187	
5-69					10,832	16,301	18,436	5,627	8,645	11,975	
0 - 74				• •	9,886	15,177	20,445	5,388	8,493	13,241	
5-79					7,594	12,242	17,978	4,296	7.606	12,018	
0-84					4,746	7,901	11,700	2,932	5,276	8,297	
5-89					2,270	3,733	5,649	1,471	2,693	4,732	
094					601	1,063	1,579	525	854	1,542	
5-99					223	309	413	143	266	402	
00 and		• •	• •	• • •	67	102	115	27	88	91	
$\mathbf{Ar}_{\mathbf{L}}$	Ages				240,940	264,736	262,094	169,052	188,607	192,519	

A feature of this table for both sexes is the marked diminution in number in evidence at the earlier ages, and the heavy increases shewn in the numbers at the later ages, the former being mainly due to marked improvement in the matter of infant mortality, and the latter to increasing numbers of persons in the population at the more advanced ages.

Commonweath Deaths in Age-groups, 1881-1910.





The accompanying graphs (Nos. 110 and 111) represent the number of deaths of each sex which occurred at each age during each of the three decennia, 1881-90, 1891-1900, and 1901-10. In both graphs the base of each small square represents 10 years of age, and the vertical height 500 deaths.

In any normally constituted population there is always in evidence a tendency for the number of deaths in quinquennial age-groups to diminish to the group 10-14, to rise thereafter to the group 70-74, or thereabouts, and diminish thereafter throughout. In Australia for the decennium 1901-10, this order of progression operated in the cases of both males and females, with some minor fluctuations. The minimum number at 10-14 was in evidence in both sexes in each of the other decennia, but the late maximum was, in the case of males, at 60-64 in 1891-90, and at 65-69 in 1891-1900. In the case of females the late maximum occurred as early as 25-29 in both of these decennia, but in 1891-1900 was succeeded by a well-defined second maximum in 65-69. These abnormalities are mainly due to the abnormal age constitution of the population from which the deaths for the decennia have been derived, and indicate the impossibility of

obtaining a satisfactory measure of the mortality of such a population from the death returns alone. They also indicate the inherent unsatisfactoriness of crude death rates for many of the purposes to which such rates are applied. To obtain satisfactory results in such cases the deaths at each age must be compared with the life experience at corresponding ages. A similar statement of the number of deaths in New South Wales in each of the decennia is given in the next table:—

New South Wales.—Deaths in Age-Groups, 1881-1910.

			Age Last Birthday.					FEMALES.			
$\mathbf{A}\mathbf{G}$	E LAST	Віктні	DAY.		1881-90.	1891–1900	1901–10.	1881–90.	1891-1900	1901–10	
0					22,645	23,486	19,349	18,891	19,316	15,726	
1					5,270	4,678	3,396	5,140	4,246	3,152	
2			• •		1,844	1,658	1,267	1,615	1,582	1,129	
3					1,144	1,077	788	1,088	1,063	733	
4					825	847	546	771	781	549	
59		• •	• •		2,231	2,298	1,790	1,966	2,147	1,565	
0-14	• •				1,323	1,513	1,446	1,136	1,257	1,252	
5-19					1,741	1,976	2,185	1,606	1,759	1,915	
20-24		• • •	• • •		2,873	2,683	2,725	2,335	2,450	2,622	
5-29		• • •	• •		3,483	3,169	2,716	2,529	2,729	2,841	
30-34					3,249	3,472	2,881	2,178	2,680	2,637	
35-39		• • •		• •	3,369	3,945	3,472	2,172	2,776	2,968	
0-44	• • •	• • •			3,430	3,850	4,128	1,966	2,209	2,755	
5-49	• • •			• •	3,668	3,912	4,613	1,915	2,138	2,632	
0-54	• • •	• •	• •	• •	3,889	4,193	4,621	1,762	2,058	2,529	
55-59			• •		3,288	4,464	4,871	1,621	2,291	2,634	
60-64					3,793	5,227	5,541	1,784	2,577	$\frac{2,034}{3,222}$	
5569	• •	• •	• •	• •	3,322	4,893	6,760	1,789	2,454	3,968	
0-74	• •	• •	• •	• •	3,328	4,435	6,960	1,761	2,510	4,167	
5-79		• •	• •	• •	$\frac{3,328}{2,680}$	3,826	5,627	1,474	2,424	3,612	
80-84	• •	• •	• •	• •	1,761	2,592	3,441	977	1,744	2,478	
55-89	• •	• •	• •	• •	854	1,302	1,798	465	893	1,436	
0-94	• •	• •	• •	• • •	243	405	578	$\frac{403}{167}$	297	497	
5-99	• •	• •	• •	• •	86	117	161	58	109	145	
.00 and (	ver				37	46	52	18	31	35	
ALL	Ages				80,376	90,064	91,712	57,184	64,521	67,199	

As in the case of the Commonwealth, the age-group 10-14 exhibited in both sexes, and in each decennium the minimum number of deaths, and the age-group 70-74 exhibited in both sexes in 1901-10 the maximum for ages above 1. For adult ages in the other two decennia the death figures do not conform to the normal type.

The number of deaths which occurred in Victoria in each of the three decennia is given in the next table, tabulated according to sex and age:—

Victoria.—Deaths in Age-Groups, 1881-1910.

٠						MALES.		FEMALES.			
AG	E LAST	Віктн	DAY.		1881–90.	1891-1900	1901–10.	1881–90.	1891-1900	1901–10	
0					21,619	20,519	15,053	18,057	17,023	11,916	
i					4,652	4,321	2,485	4,234	3,851	2,171	
2					1,612	1,432	829	1,514	1,293	812	
3					1,140	932	589	1,048	823	506	
4					918	756	411	841	680	406	
5-9					2,449	2,309	1,548	2,313	2,093	1,415	
10-14					1,501	1,390	1,266	1,433	1,283	1,167	
15-19					2,154	1,914	1,776	2,273	2.019	1,826	
20-24					3,311	2,746	2,014	3,075	2,891	2,223	
25-29					3,420	3,348	2,237	3,199	3,365	2,575	
30 - 34					2,800	3,374	2,422	2,494	3,396	2,736	
35-39					2,751	3,332	3,153	2,483	3,019	3.082	
40-44					3,158	3,004	3,646	2,474	2,406	2,890	
45-49					4,156	3,102	3,946	2,646	2,218	2,794	
50-54					5,434	3,611	3,646	2,819	2,540	2,399	
55-59			• •		5,679	4,922	3,593	2,637	2,968	2,608	
60-64					6,002	7,073	4,484	2,662	3,963	3,279	
65-69					4,732	7,603	6,516	2,408	4,018	4,749	
70-74					3,869	6,975	8,431	2,187	3,831	5,714	
75-79					2,781	5,228	8,045	1,670	3,142	5,360	
80-84					1,625	3,171	5,263	1,189	2,115	3,669	
85-89					822	1,430	2,326	608	1,034	1,970	
90-94					221	359	543	226	320	592	
95-99					89	92	149	50	78	149	
100 and	over		• •	• •	20	32	40	4	40	36	
ALL	Ages				86,915	92,975	84,411	64,544	70,409	67,044	

These results are in accord with the normal type in giving a minimum in every case in age-group 10-14, and also in giving in 1901-10 an adult maximum in age-group 70-74, but are abnormal in distribution in adult ages for the decennia 1881-90 and 1891-1900.

The death experience for Queensland classified according to sex and age is given in the following table for each of the three decennia:—

Queensland.—Deaths in Age-Groups, 1881-1910.

						MALES.		Females.			
Ac	E LAST	Віктні	DAY.		1881–90.	1891–1900.	1901–10.	1881–90.	1891-1900.	1901–10	
0					8,280	8,267	6,638	6,909	6,609	5,230	
ĭ		• • •		• •	1,990	1,536	1,035	1,811	1,432	1,040	
$\hat{2}$		• •	• •		710	670	466	677	637	430	
3	• • •	• • •	• • •		448	480	289	426	495	275	
4	• • •	• •	• •		326	311	212	289	352	213	
5-9	• • •	• • •	• • •		759	920	695	594	834	615	
0-14	• • •	• • •	• •	• •	455	562	599	342	416	456	
5-19		• •			2,332	1,300	1,011	642	497	618	
20-24			• •	• •	3,858	2,108	1,488	1,113	768	846	
5-29			• •	• •	3,045	2,320	1,548	1,066	999	931	
30-34			• • •		2,280	2,143	1,627	800	952	937	
35–39			• • •		1,690	2,034	1,833	722	900	985	
0-44	• • •				1,755	1,791	2,000	687	697	965	
5-49	• •	• • •			1,610	1,685	2,131	515	650	833	
5054	• • •		• • •		1,556	1,869	2,229	448	710	830	
55-59	• • •	• • •			1,056	1,718	1,991	400	672	854	
50-64	• • •	• • •	• • •		1.014	1,668	2,324	350	719	1,048	
69 5–69	• • •	• •	• • •		684	1,397	2,431	286	625	1,158	
0-74	• • •				532	1,085	2,179	248	532	1,092	
5-79	• • •				353	763	1,569	195	447	880	
30–84		• • •	• • •		186	459	883	120	297	585	
85–89			• • •		80	184	363	66	144	336	
0-94	• • •	• •			17	43	103	28	42	94	
5-99	• •	• •	• •		16	19	29	5	16	<b>22</b>	
00 and	over	• • •	• • •	• • •		3	5		6	6	
ALL	Ages.				35,032	35,335	35,678	18,739	20,448	21,279	

As will be noted later, the State of Queensland has now improved from the most unsatisfactory position amongst the States in 1881-90 in respect of mortality to one of the most satisfactory positions. An indication of this is furnished by the above death figures for males, which shew that for the period under review, the number of deaths increased less than 350 per decennium. The male population in the same period increased from 125,325 on 3rd April, 1881, to 329,506 on 3rd April, 1911.

The number of deaths of each sex recorded in South Australia (including the Northern Territory) for each of the three decennia are given hereunder according to age:—

South Australia.—Deaths in Age-Groups, 1881-1910. FEMALES. MALES. AGE LAST BIRTHDAY. 1901-10. 1881-90. 1891-1900. 1881-90. 1891-1900. 1901-10. 3,134 5,932 4,075 6,008 7,192 1,280 484 1,036 366 658 540 1,421 204 539 399 256 311 255265 154 339 3 203 102297 185 91 338 . .  $\frac{654}{470}$ 583 328 644  $5 - \hat{9}$ 727 427 445 661 391 387 359 343 621 784 626581 580 634 ٠. 15-19750747 20-24 798724 717 656 798 842780 814 • • 944 25-29 890 695 688 804 714  $\begin{array}{c} 30 - 34 \\ 35 - 39 \end{array}$ 830 645 891 989 799 654 555  $\begin{array}{c} 663 \\ 728 \end{array}$ 801 906 900 **582** • • 40-44 1,086 518 45-49 598 617 7029371,011 1.244 50-54 913 905 1,219 544 721 720 . . 55 - 59918 1,213 1,210 621841 988 1.388 60-64 9451,177 616 65-69 953 1.462 979 971 1,282 1,539 640 1,350 895 • • 70 - 741,326 690 1,192 1.457 536 75 - 79998  $\frac{749}{367}$ 1.146 80-84 437 195 563 183 385 649 85-89 . . 223  $\frac{51}{13}$ . . 44 102 161 140 90 - 9432 42 50 29 8 9 100 and over 18,906 17,825 22,807 22,812 21,709 18,170 ALL AGES

The South Australian death figures for each sex in both the decennia 1891-1900 and 1901-10 accord with the normal experience in exhibiting a minimum number of deaths in the age-group 10-14, and an adult maximum in the group 70-74. For the decennium 1881-90 the age-group 10-14 also exhibits a minimum in each sex, but the adult maximum is at 60-64 for males, and 25-29 for females. It will be seen that the number of male deaths for 1891-1900 was practically identical with that for 1881-90, and that the number for 1901-10 was considerably lower than either, a somewhat similar variation being in evidence in the case of females. During this period the male population increased from 149,530 on 3rd April, 1881, to 210,092 on 3rd April, 1911, while the female population increased from 130,335 on 3rd April, 1881, to 201,776 on 3rd April, 1911.

Western Australian death figures tabulated according to sex and age are given in the succeeding table for each of the three decennia:—

Western Australia.—Deaths in Age-Groups, 1881-1910.

	T	D				Males.	ļ		FEMALES.	
A.	GE LAST	BIRTHI	DAY.		1881-90.	1891–1900.	1901-10.	1881–90.	1891–1900.	1901–10
0					898	2,655	4,319	714	2,186	3,339
1					174	564	820	152	442	694
<b>2</b>					61	124	229	48	. 129	212
3					50	99	141	46	75	143
4					23	59	97	30	52	87
5-9					75	154	390	67	158	356
0-14					47	118	199	56	85	206
5-19					90	234	307	63	155	$\bf 242$
20-24					155	835	808	$9\overline{2}$	288	403
25-29					202	1,105	1,027	80	355	546
0-34					162	984	1,052	65	275	609
5-39					117	845	1,160	80	243	562
0-44					154	639	1,230	54	160	447
5-49					198	506	1,141	78	101	337
60-54					283	537	957	67	139	289
5-59					296	471	789	61	136	266
60-64					327	552	749	58	109	304
55-69					235	528	719	84	119	358
0-74					217	420	668	53	99	290
5-79					136	302	532	37	96	257
0-84					79	133	318	23	54	117
5-89					36	51	155	$\frac{14}{14}$	25	60
0-94					6	22	23	2	10	24
5-99						2	7		3	-6
00 and	over		• •	• •	2 2	2	3			
ALL	Ages				4,025	11,941	17,840	2,024	5,494	10,154

Owing to the abnormal development of Western Australia during recent years, the death statistics differ essentially in appearance from those for the other States. There is, however, the same tendency to a minimum in the group 10-14, and there is an adult maximum, but it is irregularly placed.

The following table gives for each of the three decennia, the Tasmanian death statistics, tabulated according to sex and age.

Tasmania.—Deaths in Age-Groups, 1881-1910.

Δ.	E LAST	Brown				MALES.		Females.			
	E DASI	DIKIN	DAY.		1881-90.	1891–1900.	1901–10.	1881–90.	1891–1900.	1901–10.	
0					2,644	2,588	2,566	2,130	2,039	2,019	
1.					473	416	297	400	374	261	
$^2$	• • •				190	180	120	172	148	97	
3					121	81	84	115	131	83	
4					114	96	60	86	108	74	
5-9					315	323	216	308	308	217	
10-14					180	219	211	181	182	190	
1519		·	٠.		303	278	309	319	301	340	
20 – 24					391	382	367	382	368	375	
25-29					424	387	303	347	387	351	
30-34			•		283	361	306	310	346	300	
35–39					246	412	371	243	383	343	
<b>1</b> 0 <b>44</b>					244	356	410	244	286	350	
15-49					287	333	429	264	267	293	
50-54				٠.	381	354	452	359	265	327	
55-59					485	360	462	312	311	328	
6064					758	509	508	410	415	416	
35 <del>–</del> 69					906	670	548	444	484	565	
0-74					1,045	980	668	499	542	628	
5-79					954	931	748	384	526	583	
0-84		• •			658	797	649	276	380	450	
5-89					283	399	444	135	212	281	
0-94					70	132	171	51	45	112	
5-99			• •		23	50	35	17	18	30	
00 and		•••		::	7	15	10	3	3	5	
ALL	Ages.				11,785	11,609	10,744	8,391	8,829	9,018	

With one exception the Tasmanian figures accord with the normal results throughout in giving a minimum number of deaths in the age-group 10-14, and a maximum in the group 70-74, the exception occurring in the male experience for 1901-10 for which the adult maximum occurred in the age-group 75-79. It will be seen that the number of male deaths diminished in succeeding decennia, notwithstanding an increase in the male population during the period from 61,162 on 3rd April, 1881, to 97,591 on 3rd April, 1911.

(b) Life Experience.—In addition to the data in respect of deaths for the several periods of observation, it is necessary to obtain an estimate, classified according to age, of the number of years of life experienced by the community during each of these periods. The sources of such information are primarily the decennial census results, and secondarily the periodical population estimates, and records of births. The Census results so employed on the present occasion were those for the Censuses taken in the several States on 3rd April, 1881; 5th April, 1891; 31st March, 1901; and 3rd April, 1911. The totals for each sex, exclusive of full-blooded aboriginals, are as follows:—

### Australian Census Results, 1881 to 1911 (Exclusive of Full-blooded Aboriginals).

		M	ALES.		Females.			
STATE.	3rd April,	5th April,	31st Mar.,	3rd April,	3rd April,	5th April,	31st Mar.,	3rd April,
	1881.	1891.	1901.	1911.	1881.	1891.	1901.	1911.

### NUMBER.

	I	1		1	11	1	I	1
New South Wales	 410,211	608,003	710,005	858,690	339,614	515,951	644,841	789,758
Victoria	 451,623	598,089	603,720	655,591	409,943	541,751	597,350	659,960
Queensland	 125,325	223,779	277,003	329,506	88,200	169,939	221,126	276,307
South Australia	 149,530	166,801	184,701	210,092	130,335	153,630	178,456	201,776
Western Australia	 17,062	29,807	112.875	161,565	12,646	19,975	71,249	120,549
Tasmania	 61,162	77,560	89,624	97,591	54,543	69,107	82,851	93,620
Commonwealth	 1,214,913	1,704,039	1,977,928	2,313,035	1,035,281	1,470,353	1,795,873	2,141,970
	J				li	j		

# PROPORTION PER CENT.

New South Wales	 % 33.76	35.68	35.90 30.59	37.12	32.80	35.09	35.91	36.87
Victoria Queensland South Australia	37.17 $10.32$ $12.31$	35.10 13.13 9.79	$30.52 \\ 14.00 \\ 9.34$	28.34 14.25 9.08	$39.60 \\ 8.52 \\ 12.59$	$   \begin{array}{r r}     36.84 \\     11.56 \\     10.45   \end{array} $	$33.26 \\ 12.31 \\ 9.94$	$\begin{array}{c c} 30.81 \\ 12.90 \\ 9.42 \end{array}$
Western Australia	$1.41 \\ 5.03$	1.75 4.55	5.71 4.53	6.99 4.22	1.22 5.27	1.36 4.70	3.97 $4.61$	5.63 4.37
Commonwealth	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

While all the States have shown substantial increases in population during the thirty years under review, the proportion of each State's contribution to the Commonwealth total, has increased continuously from Census to Census in the case of New South Wales, Queensland, and Western Australia, and has decreased continuously in the case of Victoria, South Australia and Tasmania.

At all the Censuses taken in Australia there has been a somewhat large number of persons concerning whom data as to age were not furnished. The number so unspecified totalled 13,221 for the whole Commonwealth in 1901, and 23,384 in 1911, the former representing 0.35 per cent. of the total population, and the latter 0.52 per cent. In all cases in preparing the data for the construction of the life tables the numbers unspecified were proportionately distributed over the specified ages, regard being taken to the indications, if any, furnished as to whether the unspecified persons were adults or children. Where such distinction was made the "children" were distributed over ages 0 to 14, the "adults" over ages 15 and upwards.

Details in respect of sex and age of the population of Australia at the Censuses of 1881 to 1911 are furnished in the following table, persons of unspecified age being distributed in accordance with the methods indicated above, and ages being stated in quinquennial groups throughout.

				M	ALES.		Females.				
AGE LAS	т Віктно.	AY.	3rd April, 1881.	5th April, 1891.	31st Mar., 1901.	3rd April, 1911.	3rd April, 1881.	5th April, 1891.	31st Mar., 1901.	3rd April 1911.	
0-4	• •		161,494	226,584	220,204	268.073	157.816	220,988	214,913	258,850	
5-9			144,988	196,241	231,368	230,159	143,130	191,179	226,020	224,206	
10-14			136,169	170,466	218,699	216,344	132,956	167,090	214,983	212,870	
15-19			120,344	154,171	190,656	228,329	120,662	153,540	188,771	223,138	
20-24			117,642	171,154	175,490	229,702	107,485	157,875	177,021	219,495	
25-29			96,130	174,291	163,326	201,263	74,003	138,730	157,030	189,669	
30-34			78,230	143,519	157,129	172,276	60,010	105,458	136,394	160,878	
35-39			74,878	104,847	152,877	152,903	56,054	74,869	120,744	140,467	
40-44			71,199	80,301	126,681	145,848	50,074	60,159	95,391	125,462	
45-49			63,554	70,137	89,111	133,976	41,982	52,749	65,888	109,242	
50-54			55,101	63,477	67,563	108,859	32,241	46,374	52,686	85,336	
55-59			33,522	51,409	52,913	72,541	20,552	35,980	43,136	57,290	
60-64			27,816	42,613	46,257	51,759	17,153	27,609	37,166	44,262	
6569			15,553	24,268	38,701	40,491	9,695	16,484	30,485	36,700	
70-74			10,142	16,817	26,015	29,255	6,323	11,620	18,450	26,176	
75-79			4,871	8,332	12,668	18,951	3,080	5,754	9,710	16,609	
80-84			2,531	3,750	6,063	8,863	1,527	2,645	5,047	7,740	
85-89			540	1,201	1,669	2,651	362	923	1,563	2,720	
90 - 94			142	373	409	641	122	263	385	704	
95-99			35	67	99	116	42	47	70	127	
100 and	over		32	21	30	35	12	17	20	29	
ALL	Ages	٠.	1,214,913	1,704,039	1,977,928	2,313,035	1,035,281	1,470,353	1,795,873	2,141,970	

This table furnishes evidence of the change in age constitution which has taken place in the population of the Commonwealth during the thirty years under review. Thus, whilst in both sexes, the population in the group 20-24 was approximately twice as great in 1911 as in 1881, the 1911 figures for ages under 20 were less than twice the corresponding figures for 1881, and for ages above 25 the 1911 figures were in practically all cases more than twice as great as those for 1881. In some cases they were more than five times as great.

Population figures for New South Wales, classified according to sex and age, are furnished in the following table for the Censuses of 1881, 1891, 1901 and 1911:—

New South Wales.—Population in Sex and Age-Groups, 1881 to 1911.

				M	ALES.			Fем	ALES.	
AGE LAS	т Віктно	AY.	3rd April, 1881.	5th April, 1891.	31st Mar., 1901.	3rd April, 1911.	3rd April, 1881.	5th April 1891.	, 31st Mar., 1901.	3rd April, 1911.
0-4			56,286	83,640	80,398	102,329	54,942	81,354	78,567	99,168
5-9			49,980	72,511	84,283	85,429	49,130	70,977	81,961	83,388
1014			45,164	61,840	81,675	79,425	43,398	60,867	80,112	78,252
15 – 19			38,248	53,931	70,772	83,622	37,556	54,160	70,814	81,611
20-24			40,140	57,666	62,758	87,993	34,474	53,133	64.890	83,423
25 – 29			35,123	59,752	56,552	77,023	25,482	46,673	56,105	72,881
30-34			29,422	51,933	52,858	64,726	21,273	36,424	46,750	60,313
35-39	• •		27,395	40,238	52,593	55,556	19,062	27,110	41,640	51,062
40-44			24,293	31,227	45,153	51,319	15,289	22,003	33,474	43,768
45 - 49			19,467	26,865	33,504	47,003	11,893	18,491	24,028	37,844
50-54			15,681	22,586	25,742	39,652	8,833	14,662	19,348	30,17
55-59			9,105	16,644	19,732	27,773	5,922	10,721	15,393	21,056
60-64			8,367	12,504	16,816	20,181	5,527	7,677	12,204	16,467
35-69			5,144	6,945	13,070	15,497	3,147	4,865	9,247	13,109
70-74			3,468	4,997	7,810	10,699	2,057	3,658	5,208	8,646
75–79	• •	• • •	1,648	2,837	3,595	6,706	992	1,903	2,848	5,277
80-84	• •		984	1,291	1,892	2,740	467	876	1,574	2,241
35-89	• •		210	<b>421</b>	567	778	111	284	511	790
90-94	• •		55	142	174	185	37	79	138	242
9599	• •	• •	14	21	49	35	13	27	25	34
100 and	over	• •	17	12	12	19	9	7	4	12
ALL	Ages		410,211	608,003	710,005	858,690	339,614	515,951	644,841	789,758

The succeeding table gives the Census data in respect of sex and age for the population of Victoria at the Censuses of 1881, 1891, 1901 and 1911 :=

Victoria.—Population in Sex and Age-Groups, 1881-1911.

		,		M	ALES.			FEM	FEMALES.				
AGE LAS	т Віктн	DAY.	3rd April, 1881.		31st Mar, 1901.	3rd April, 1911.	3rd April, 1881.	5th April, 1891.	31st Mar., 1901.	3rd April 1911.			
0-4 5-9			57,789 54,801	75,185 65,418	66,954 72,220	73,278 65,811	56,321 54,414 53,883	73,471 63,529 57,757	65,284 70,614 66,752	70,622 64,089 62,703			
$10-14 \ 15-19 \ 20-24$	• •	• •	54,285 49,413 40,567	58,876 57,096 63,601	67,539 59,188 50,841	63,775 68,204 62,260	51,167 43,294	57,691 62,381	59,922 57,820	$68,191 \\ 65,673$			
25–29 30–34 35–39	••		27,437 22,599 23,399	63,180 47,864 31,824	45,693 46,870 46,956	52,262 45,194 41,552	26,963 21,933 21,550	$55,220 \\ 39,840 \\ 26,508$	53,007 48,319 43,539	56,040 $49,035$ $44,861$			
40-44 45-49	•••	• •	25,907 28,322	24,034 22,111	37,304 24,251	42,763 41,257	21,218 19,428 15,283	21,430 $19,651$ $19,386$	33,664 21,881 17,651	42,776 $38,746$ $29,626$			
5054 5559 6064	• •		$\begin{array}{r} 26,407 \\ 15,958 \\ 12.036 \end{array}$	$\begin{array}{c} 22,804 \\ 22,264 \\ 20,213 \end{array}$	18,432 15,416 15,050	32,054 19,601 13,916	9,114 6,999	16,220 $12,915$	15,209 14,338	18,586 $14,418$			
65–69 70–74 75–79	• •		6,149 3,679 1,778	11,144 7,240 3,210	16,162 11,839 5,762	11,499 9,471 7,318	3,798 $2,522$ $1,214$	7,181 $4,803$ $2,267$	13,891 8,388 4,247	$12,692 \\ 10,041 \\ 6,982$			
75–79 80–84 85–89	•••	• • •	849 179	1,389 463	2,465 606	3,926 1,140	621 155	1,012 359	2,073 588 125	$3,411 \\ 1,136 \\ 266$			
90-94 95-99 100 and	over	• •	43 15 11	145 23 5	130 30 12	268 34 8	47 19	$\begin{array}{c} 112 \\ 13 \\ 5 \end{array}$	27 11	56 10			
	Ages		451,623	598,089	603,720	655,591	409,943	541,751	597,350	659,960			

Queensland Census results in respect of sex and age are furnished in the next table for the Censuses of 1881, 1891, 1901 and 1911:—

Queensland.—Population in Sex and Age-Groups, 1881-1911.

				М	ALES.			Fем	ALES.	
AGE LAST	Age Last Birthday.		3rd April, 1881.	5th April, 1891.	31st Mar., 1901.	3rd April, 1911.	3rd April, 1881.	5th April, 1891.	31st Mar., 1901.	3rd April 1911.
0-4 5-9 10-14 15-19 20-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84			16,182 13,638 11,704 9,666 12,631 13,234 11,241 10,853 9,917 6,419 4,319 2,240 1,668 837 464 195	30,463 23,819 19,902 18,456 24,041 25,676 21,312 15,566 12,192 10,522 9,173 5,441 3,578 1,784 1,076 512	31,410 32,014 29,099 24,158 25,084 24,107 23,092 22,525 18,788 13,307 10,358 8,115 6,897 4,200 2,268 975 461	37,804 32,135 31,521 32,903 33,864 29,280 24,637 21,578 20,243 18,916 15,321 10,352 7,532 5,935 4,293 2,119 774	15,761 13,414 11,200 8,736 8,712 6,703 5,653 5,563 4,422 2,954 2,004 1,220 899 478 267 133 56	29,877 23,276 19,256 17,180 18,705 15,954 12,153 8,540 6,864 6,104 4,686 2,981 1,990 1,145 729 302 133	30,808 31,069 28,670 22,922 21,307 18,388 16,050 13,783 10,772 7,444 6,054 4,927 3,965 2,405 1,385 706 344	36,044 31,475 31,051 31,065 29,575 23,641 19,398 16,834 14,692 12,316 9,572 6,392 4,946 4,183 2,808 1,419 600
85-89 90-94 95-99 100 and	••	••	18 4 2	53 12 6	109 27 7 2	236 52 9 2	15 9 1	50 11 3	94 24 6 3	232 50 10 3
ALL A			125,325	223,779	277,003	329,506	88,200	169,939	221,126	276,307

The population of South Australia (including the Northern Territory) at the Censuses of 1881, 1891, 1901 and 1911, is given in the following table, classified according to sex and age :— -

South Australia.—Population in Sex and Age-Groups, 1881-1911.

				M	ALES.			FEM	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
Age Las	т Віктні	DAY.	3rd April, 1881.	5th April, 1891.	31st Mar., 1901.	3rd April, 1911.	3rd April, 1881.	5th April, 1891.		3rd April
0-4			21,028	23.015	20,295	24,237	20,656	22,266	19.852	23,561
5–9			17,407	21,827	22,796	20,600	17.357	21,267		19,984
10-14	• •	• • •	16,207	19,162	22,232	19,689	16,068	18,641		19.516
15–19		• • •	14,801	15,363	20,041	21,725	14,991	15.617		21,548
20-24			16,907	15,380	16,669	21,836	13,844	14,923		20,802
25-29			15,032	14,400	13,795	19,288	10,195	12,937		18,673
30-34			10,965	13,426	12,967	15,321	7.689	10,690		14,844
35 - 39			9,625	10,758	12,033	12,575	6,670	8,290		12,320
10-44			7,344	8,115	11,390	11,882	6,045	6,339		11,309
15-49	٠,		5,672	6,827	9,048	10,752	4,949	5,517	7,289	10,125
50-54			4,897	5,401	6,770	10,022	3,871	4,931	5,576	8,408
55-59			3,336	4,094	5,336	7,538	2,691	3,837	4,545	6,236
60-64			2,770	3,529	3,992	5,188	2,250	3,251	4,026	4,656
5-69			1,607	2,378	2,872	4,082	1,406	2,169	3,051	3,760
<b>70–74</b>			1,102	1,723	2,282	2,610	904	1,534	2,280	2,734
75–79			537	850	1,290	1,545	447	830	1,262	1,828
80 – 84			227	404	646	825	232	389	698	977
35-89			52	123	197	289	49	156	240	375
0-94			13	21	43	68	14	40	61	99
5-99			1	5	4	19	6	3	8	19
00 and	over	••		••	3	1	1	3	1	2
Alt.	Aces		149,530	166,801	184,701	210,092	130,335	153,630	178,456	201,776

Western Australian results for the Censuses of 1881, 1891, 1901 and 1911 are given in the following table tabulated according to sex and age:—

Western Australia.—Population in Sex and Age-Groups, 1881-1911.

				M.	ALES.			FEM	ALES.	
AGE LAST BIRTHDAY.		3rd April, 1881.	5th April, 1891.	31st Mar., `1901.	3rd April, 1911.	3rd April, 1881.	5th April, 1891.	31st Mar., 1901.	3rd April 1911.	
0-4			2,082	3,442	10,445	17,752	2,071	3,393	10,239	17,276
5-9			1,888	2,787	8,895	14,843	1,847	2,610	8,861	14,438
10-14			1,812	2,402	7,505	11,818	1,744	2,392	7,325	11,668
15–19			1,515	2,252	7,109	11,893	1,547	2,072	5,854	10,887
20-24			1,396	\$3,312	11,877	14,845	1,223	2,150	7,284	10,662
25-29			1,109	3,824	15,870	15,626	849	1,882	8,683	10,506
30-34			835	2,924	14,890	15,782	686	1,416	7,304	10,661
35–39			1,041	1,984	12,479	15,691	648	977	5,327	9,991
LO-44			1,161	1,412	8,749	14,048	617	770	3,395	7,982
15-49	٠		1,239	1,233	5,237	10,855	494	645	2,151	5,690
50-54			1,120	1,213	3,464	7,411	324	566	1,678	3,773
55–59			703	1,031	2,318	4,237	216	437	1,177	2,444
60-64			600	887	1,773	2,813	188	289	908	1,832
35–69			263	524	1,105	1,886	94	155	570	1,330
70–74			183	376	693	1,135	59	130	279	819
75-79			75	133	290	581	25	51	133	379
80-84			31	51	140	256	12	26	56	139
35 <b>–8</b> 9			6	14	30	64	2	10	21	59
90-94			3	5	5	25		4	3	10
95–99					1	3	l		1	l i
100 and	over	• •	••	· · 1	• •	1			• •	2
ALL A	GES		17,062	29,807	112,875	161,565	12,646	19,975	71,249	120,549

The next table contains the results for the Tasmanian Censuses of 1881, 1891, 1901 and 1911, tabulated according to sex and age:—

				M	ALES.			$\mathbf{F}_{\mathbf{EM}}$	ALES.	
AGE LAS	r Birthday.		3rd April, 1881.	5th April, 1891.	31st Mar., 1901.	3rd April, 1911.	3rd April, 1881.	5th April, 1891.	31st Mar., 1901.	3rd April 1911.
0-4			8,127	10,839	10,702	12,673	8,065	10,627	10,163	12,179
5–9	• •		7,274	9,879	11,160	11,341	6,968	9,520	10,864	10,832
10-14	• •		6,997	8,284	10.649	10.116	6,663	8,177	10,487	9,680
15–19			6,701	7,073	9,388	9,982	6,665	6.820	9,063	9,836
20-24	••		6,001	7,154	8,261	8,904	5,938	6,583	8,149	9,360
25-29			4,195	7,459	7,309	7,784	3,811	6,064	6,570	7,928
30-34			3,168	6,060	6,452	6,616	2,776	4,935	5,582	6,627
35-39			2,565	4,477	6,291	5,951	2,561	3,444	5,222	5,399
<b>1</b> 0– <b>4</b> 4			2,577	3,321	5,297	5,593	2,483	2,753	4,473	4,935
<b>45</b> – <b>49</b>			2,435	2,579	3,764	5,193	2,264	2,341	3,095	4,521
50-54			2,677	2,300	2,797	4.399	1,926	2,143	2,379	3,783
55-59			2,180	1,935	1,996	3.040	1,389	1,784	1,885	2,576
60-64			2,375	1,902	1,729	2,129	1,290	1,487	1,725	1,943
65–69			1,553	1,493	1,292	1,592	772	969	1,321	1,626
70-74			1,246	1,405	1,123	1,047	514	766	910	1,128
75–79			638	790	756	682	269	401	514	$\bf 724$
80-84			347	420	459	342	139	209	302	371
85–89			75	127	160	144	30	64	109	128
90-94			24	48	30	43	15	17	34	37
95–99			3	12	8	16	3	1	3	7
100 and	over	• •	4	3	1	4	. 2	2	1	
ALL A	GES		61,162	77,560	89,624	97,591	54,543	69,107	82,851	93,620

The preceding tables furnish, in respect of the Commonwealth and its component States, the population and its age and sex distribution at the four Censuses specified. In the absence of further population data it would be necessary, for the purpose of determining the years of life experienced in each decennium in each age-group, to make some assumption as to the rate of growth of the population in each case. For example, in the above Tasmanian table the number of males in group 20-24 was 6001 on 3rd April, 1881, and 7154 on 5th April, 1891. assumed that between these points and also for the portion of 1881 prior to the date of the Census the growth of population in this age-group had been linear, that is, had proceeded by means of equal numbers added per annum, the number of years of life experienced in this age-group could readily be determined for each year of the decade 1881-90, and hence by addition or integration for the whole of the decennium. If a similar assumption and calculation were made for each age-group, there would be produced a series of results showing an estimated mean male population for each year of the decade, classified according to age. Such a result is open to the evident objection that, as the mean male population is already known independently by means of the records of births, deaths, arrivals and departures corrected to accord with Census results, it is not warrantable to recast it on the assumption of a linear progression from one Census to the next. A similar objection would apply to an assumption that the number in each age-group increased in geometrical progression instead of linearly. Such an assumption would be further complicated in application by the fact that whilst in the case of assumed linear progressions the totals of the age-groups for each year of the decade will coincide with the corresponding figures for a linear progression of the total population, when a separate geometrical progression is assumed for each age-group and for the total, the aggregate of the computed age-group result will not in practice agree with the separately computed result for the total population. case there will be three different estimates of the mean male population for any year of the decade, viz., (a) the mean determined from corrected returns of migration and natural increase; (b) the mean determined by aggregating the computed results for age-groups; and (c) the mean determined on the assumption that the male population as a whole increases in geometrical progression, of which the last two take no account of the recorded fluctuations during the decennium. In the construction of life tables based on the data of two Australian Censuses, it has been usual to employ one or other of the assumptions indicated above, that is, to assume that the population in each age-group has increased during the decennium either linearly or else in geometrical progression, thus ignoring intercensal records. Although such records are admittedly defective in certain

respects, it is believed that, when subjected to the post-censal adjustment indicated in Chapter IX. hereinbefore, they furnish valuable data respecting the fluctuations of population, and should not be ignored in the computation of the years of life for life table purposes. In the preparation of the present series of tables the work has proceeded on the basis of taking the adjusted intercensal record as furnishing the correct aggregate amount of life experienced during the decennium, and the initial and final Censuses as furnishing the scale for distributing that aggregate according to age. If the proportion of the population in each age-group were the same respectively at the two Censuses, it would of course be immaterial which Census results were taken as a scale, but since, as indicated earlier in the present section, there have been marked changes in age distribution, from Census to Census, the scale applicable to any decennium will be neither the one nor the other, but a scale or scales occupying a mean position between them. For the purpose of determining such a scale or series of scales, the ratio of the population in each age-group to the total population was computed for each pair of successive Censuses, and the assumption was made that the change in ratio so disclosed as having taken place during the decennium, had proceeded linearly in each age-group throughout that period. By such means a scale applicable to the mean population of each year of the decennium could readily be determined, and the addition of the allocations so obtained would give the allocation according to age of the aggregate experience of the decennium. In actual application, however, it is not necessary to compute the series of scales described above, as the work may be considerably shortened by mathematical considerations, which are set out in note A, page 345. As shewn there, the life experience during the decennium for any age-group may be represented by the formula

$$\left\{ r_1 - \frac{1}{40} (r_2 - r_1) \right\} \int_0^{10} t dt + \frac{1}{10} (r_2 - r_1) \int_0^{10} P_t dt$$

where  $r_1$  denotes the ratio to total for the particular age-group at the earlier, and  $r_2$  the corresponding ratio at the later Census,  $P_t$  denotes the total population at any point of time t during the decennium, so that t may have any value from 0 to 10. To enable this formula to be applied it is necessary to have the population at regular intervals throughout the period of observation.

This is furnished in the following table, which gives the male and female population of the Commonwealth and its component States at 31st December, in each of the years 1880 to 1910:—

### Australian Population, 1880 to 1910.

31st Dec.—	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	C'wlth.

### MALES.

1880			404,952	450,558	124,013	147,438	16,985	60,568	1,204,514
1881			426,933	457,782	130,080	152,453	17,316	62,495	1,247,059
1882			444,138	466,788	142,489	154,921	17,752	63,804	1,289,892
1883			470,291	477,671	166,545	159,586	18,335	64,995	1,357,423
1884			494,307	490,266	178,482	163,262	19,145	66,534	1,411,996
1885			518,606	504,097	186,866	162,425	20,688	67,712	1,460,394
1886			538,284	523,864	194,749	160,814	23,979	69,264	1,510,954
1887			553,084	541,216	204,817	162,371	26,039	71,591	1,559,118
1888			568,273	571,425	212,078	160,459	25,831	72,482	1,610,548
1889	. •		582,528	582,672	218,697	164,065	26,890	74,242	1,649,094
1890			602,704	595,519	223,252	166,049	28,854	76,453	1,692,831
1891			622,523	606,395	226,759	168,826	32,176	79,938	1,736,617
1892			636,276	608,666	231,167	174,862	36,048	79,753	1,766,772
1893			646,735	609,500	235,975	179,850	40,975	78,780	1,791,815
1894			658,354	609,379	241,905	180,239	55,055	79,285	1,824,217
1895			668,209	607,933	248,865	180,314	69,733	80,485	1,855,539
1896			675,857	599,497	253,112	179,024	96,999	82,685	1,887,174
1897			687,966	599,621	258,662	178,404	107,655	85,152	1,917,460
1898			698,009	598,332	265,644	179,865	107,593	88,186	1,937,629
1899			707,164	599,765	271,891	183,101	106,816	90,337	1,959,074
1900			716,047	601,773	274,684	184,637	110,088	89,763	1,976,992
1901			720,840	608,436	282,291	184,439	117,885	90,945	2,004,836
1902			736,142	604,318	284,215	181,392	128,370	93,571	2,028,008
1903	• •		748,821	599,950	286,871	180,138	134,140	95,224	2,045,144
1904			765,713	597,617	289,785	182,023	141,694	95,951	2,072,783
1905	. •		782,897	598,134	291,807	184,835	146,498	95,947	2,100,118
1906			800,820	600,856	294,063	188,051	148,061	94,879	2,126,730
1907			823,413	605,775	296,670	191,118	146,264	96,973	2,160,213
1908			832,419	614,937	302,370	197,866	148,447	97,942	2,193,981
1909			845,228	631,021	314,481	201,646	151,325	98,514	2,242,215
1910			85 <b>8,</b> 181	646,482	325,513	209,295	157,971	<b>98,</b> 86 <b>6</b>	2,296,308
	••	••	350,101	040,402	020,010	200,200	10.,0.1	20,000	_,200,000

## Australian Population, 1880 to 1910—continued.

31st Dec.—	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	C'wealth.
	ì	<b>†</b>					

FEMALES.

									1
1880			336,190	408,047	87,027	128,955	12,576	54,222	1,027,017
1881			350,092	416,183	91,769	133,518	12,840	55,275	1,059,677
1882			365,265	425,977	99,840	137,171	13,264	56,673	1,098,190
1883			385,107	434,782	114,070	142,321	13,751	58,282	1,148,313
1884			404,896	445,511	123,105	145,685	14,401	60,131	1,193,729
1885			425,261	455,741	129,815	146,888	15,271	61,148	1,234,124
1886			445,234	469,853	137,562	145,896	16,625	61,926	1,277,096
1887			461,523	484,260	147,063	147,667	17,781	63,950	1,322,244
1888			476,017	507,652	155,088	148,994	17,983	65,395	1,371,129
1889			491,612	522,266	162,792	150,524	18,770	67,419	1,413,383
1890			510,571	538,209	168,864	152,898	19,648	68,334	1,458,524
1891			530,647	551,977	173,636	155,895	21,001	71,212	1,504,368
1892			546,881	560,081	178,509	160,530	22,521	70,459	1,538,981
1893			559,762	566,670	183,018	165,066	23,948	71,616	1,570,080
1894			573,401	572,776	188,086	168,535	26,524	73,221	1,602,543
1895			587,294	577,743	194,199	171,654	30,782	74,410	1,636,082
1896			596,507	580,353	199,593	173,043	39,817	76,611	1,665,924
1897			607,623	582,485	204,632	173,933	52,840	78,810	1,700,323
1898			619,436	583,949	209,217	174,948	59,285	80,251	1,727,086
1899			632,050	588,776	214,424	176,197	63,442	82,025	1,756,914
1900			644,258	594,440	219,163	177,470	69,879	83,137	1,788,347
1901			654,615	601,464	224,430	179,564	75,716	84,288	1,820,077
1902			665,801	603,913	228,025	180,089	83,603	85,879	1,847,310
1903			676,362	604,792	230,857	181,129	90,608	87,700	1,871,448
1904			689,745	607,991	235,150	181,551	97,714	89,216	1,901,367
1905			704,987	612,287	239,675	181,832	103,640	90,438	1,932,859
1906			720,798	618,976	244,910	182,366	107,112	90,593	1,964,755
1907	, .		738,159	627,032	249,135	186,282	108,276	92,625	2,001,509
1908			751,504	635,512	254,729	191,537	111,224	93,791	2,038,297
1909			768,671	646,001	263,364	194,754	114,350	94,605	2,081,745
1910			785,674	654,926	273,503	200,874	118,861	94,937	2,128,775

An example of the actual work of computing the years of life will perhaps make the process clearer. For this purpose the figures for New South Wales males for the decennium 1891-1900 have been selected. The first step is that of determining the population integrals, which, was done by means of Simpson's rule, the work being as follows:—

New South Wales.—Males, 1891—1900. Population Integrals.

	Yеа		_	<i>t</i> .	Pt.	Integrating Co-efficient.	Pt × Co-efft.	$tPt \times  ext{Co-efft.}$
1890				0	602,704	1	602,704	2 400 000
1891	• •	• •	• •	.1	622,523	4	2,490,092	2,490,092
1892	• •		• • •	2	636,276	2	1,272,552	2,545,104
1893		• •		3	646,735	4	$2,\!586,\!940$	7,760,820
1894		٠.		4	658,354	2	1, <b>3</b> 16,708	5,266,832
1895				5	668,209	4	2,672,836	13,364,180
1896				6	675,857	2	1,351,714	8,110,284
1897				7	687,966	4	2,751,864	19,263,048
1898				8 -	698,009	2	1,396,018	11,168,144
1899				9	707.164	4	2,828,656	25,457,904
1900				10	716,047	1	716,047	7,160,470
							19,986,131	102,586,878

$$\int_{0}^{10} t \, dt = \frac{19,986,131}{3} = 6,662,044: \qquad \int_{0}^{10} P_{t} \, dt = \frac{102,586,878}{3} = 34,195,626$$

The integral  $\int_0^{t_0} t \, dt = 6,662,044$  gives the aggregate number of years of male life experienced in New South Wales during the decennium 1891-1900, and the next step of the process is that of distributing this experience according to age. The other integral has no significance except as a step in this process of distribution. The actual work of distribution is shewn in full in the following table:—

New	South	WalesMales.	1891-1900.	Distribution (	οf	Years	of	Life	Experienced.
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AGE LAST BIRTHDAY.		Ratio to Total.		Ratio to	10[(5)-(3)]	₹ (6)	(3)–(7)	$\begin{pmatrix} (8) \times \\ \int_{0}^{10} P_{i} dt \end{pmatrix}$	$\int_{0}^{10} t P_{t} dt$	Age Distribution of experience. (9) +(10)
(1)	(2)	(3)	(4)	Total. (5)	(6)	(7)	(8)	. (9)	(10)	(11)
0-4 5-9 10-14 15-19 20-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85-89 90-94 90-94 90-91 100 and over	83,640 72,511 61,840 53,931 57,666 59,752 51,933 40,238 31,227 26,865 22,586 16,644 12,504 6,945 4,997 2,837 1,291 142 21 112 21	.1375651 .1192609 .1017100 .0387019 .0948449 .0982758 .0854157 .0661806 .0513600 .0441856 .0371479 .0273749 .0205657 .0114227 .0082187 .0046661 .0021233 .0006924 .0002336 .0000345	80,398 84,283 81,675 70,772 62,758 56,552 52,858 52,593 45,153 33,504 25,742 19,732 16,816 13,070 3,595 1,892 1,892 1,892 1,894 1,894 1,894 1,895 1,894 1,895 1,895 1,895 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,896 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,996 1,99	.1132358 .1187076 .1150344 .0996782 .0883909 .0796501 .0744474 .0740741 .0835953 .0471884 .036843 .0109999 .0050634 .0026648 .0007986 .0002451 .0000690	$\begin{array}{l}0018626 \\0010968 \\0010968 \\ +.0007893 \\ +.0012235 \\ +.0003003 \\ +.0000892 \\ +.0000416 \\ +.0002781 \\ +.0000327 \\ +.0000347 \\ +.0000106 \\ +.0000012 \\ +.0000012 \\ +.0000013 \end{array}$	$\begin{array}{c} -000138 \\ +000331 \\ +0002744 \\ -000161 \\ -0002742 \\ +0001973 \\ +0000751 \\ -000023 \\ -000023 \\ +0000104 \\ +0000780 \\ +0000985 \\ +0000099 \\ +0000135 \\ \end{array}$	.1381733 .1192747 .1013769 .0884275 .0950062 .0987414 .0856899 .0659833 .0510541 .0441105 .0273645 .0204877 .0112481 .0081492 .0021098 .0006898 .0006898 .0006333 .0000198	920,517 794,613 675,377 589,108 632,935 657,820 439,584 340,125 293,866 247,630 182,303 136,490 74,935 54,290 31,020 14,056 4,595 1,554 224 224	83,1951,891 +45,562 +37,53322,07068,69337,506 +26,991 +41,838 +10,2693,050 +1,423,889 +9,510 +1,358 +1,853 +362 +41 +12010	837,322 792,722 720,939 626,641 610,865 594,127 533,364 466,575 381,963 304,135 244,580 183,726 147,156 98,824 63,800 32,378 15,909 4,937 1,595 344 344 122
TOTAL	608,003	1.0000000	710,005	1.0000000	••		1.0000000	6,662,044		6,662,044

The figures furnished in column (11) give the distribution in quinquennial age-groups of the New South Wales male life experience for 1891-1900. As indicated earlier, the result is the same as would be obtained by separately distributing according to age the mean population for each year of the decennium and adding together the details so obtained. For the purpose of practically testing this equality the figures for New South Wales males for the decennium 1891-1900 were dealt with in the manner stated, and the result compared with that obtained in column (11) above. The deviations were as follows:—

Deviation of Alternative Results from those given in Column (11) above.

					THOSE BITCH IN CO.	. ,	
	Age Last Birthday.		Deviation.	Age Last Birthday.	Deviation.	Age Last Birthday.	Deviation.
0-4 5-9 10-14 15-19 20-24 25-29 30-34			$     \begin{array}{r}       -14 \\       +1 \\       +7 \\       +6 \\       -6 \\       -12 \\       -6    \end{array} $	35-39 40-44 45-49 50-54 55-59 60-64 65-69	+3 +7 +1 -3 -2 +4 +5	70-74 75-79 80-84 85-89 90-94 95-99 100	+1  +2  +1 +3 +2

That is to say the two sets of results were as nearly as practicable identical.

In the manner exemplified above the extent and the age distribution of the life experience of each sex in each decennium were computed for the Commonwealth and each of its component States.

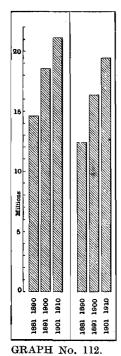
The following table shews the total number of years of life experienced in each State and also the proportion which each contributed to the Commonwealth total.

Years of Life Experienced in Australia, 1881 to 1910.

		Tears of I	не турененсе	ı ii Australia,	1001 10 1010.		
		_	Males.			FEMALES.	
STATE.		1881–90.	1881–90. 1891–1900.		1881–90.	1891–1900.	1901–10.
			NU	MBER.			
New South Wales		5,101,143	6,662,044	7,843,071	4,227,990	5,832,261	7,085,601
Victoria		5,134,838	6,040,632	6,085,658	4,632,390	5,732,524	6,182,818
Queensland		1,810,294	2,483,400	2,943,181	1,289,712	1,939,491	2,416,046
South Australia		1,598,666	1,780,215	1,887,100	1,441,006	1,685,153	1,847,891
Western Australia		218,775	719,917	1,395,217	156,807	384,624	986,13
Tasmania	• •	681,776	828,267	954,576	611,701	754,949	898,555
Commonwealth	]	14,545,492	18,514,475	21,108,803	12,359,606	16,329,002	19,417,04
			PROPORTIO	N PER CENT	Г.		
New South Wales		35.07	35.98	37.16	34.21	35.72	36.49
Victoria		35.30	32.63	28.83	37.48	35.11	31.84
Queensland		12.45	13.41	13.94	10.43	11.88	12.44
South Australia		10.99	9.62	8.94	11.66	10.32	9.52
Western Australia		1.50	3.89	6.61	1.27	2.35	5.08
Tasmania	••	4.69	4.47	4.52	4.95	4.62	4.63
COMMONWEALTH		100.00	100.00	100.00	100.00	100.00	100.00

In both sexes, New South Wales, Queensland and Western Australia contributed a higher, and Victoria, South Australia and Tasmania a lower proportion in the decennium 1901-10 than in 1881-90.

Years of Life. C'wealth, 1881-1910. MALES. FEMALES.

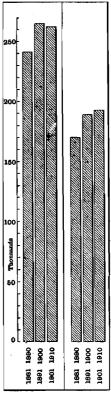


From these tables and that given on page 302 it will be seen that the Male Life Tables for the Commonwealth as a whole for 1901-1910 is based upon 21,108,803 years of life and 262,094 deaths, while the corresponding female table has as basis 19,417,043 years of life and 192,519 deaths. These data give a mean male death rate for the decennium of 12.42 per 1000, and a corresponding female rate of 9.91 per 1000.

The accompanying graphs (Nos. 112) and 113) furnish representations of the relative extent of the data on which the Life Tables for the Commonwealth for the three successive decades have been based. Graph No. 112 shews for each decade the number of years of life experienced by persons of each sex, while graph No. 113 shews the number of deaths of each sex experienced during the corresponding periods. It should be noted that the scale for graph No. 113 is a hundred times that for graph No. 112, an inch of the former denoting 80,000, while an inch of the latter denotes 8,000,000.

From the above figures it will be seen that the mean population of the Commonwealth for the three decennia under review was as follows:—

Deaths. C'wealth, 1881-1910. MALES. FEMALES.



GRAPH No. 113.

Mean Population of Australia, 1881-1910.

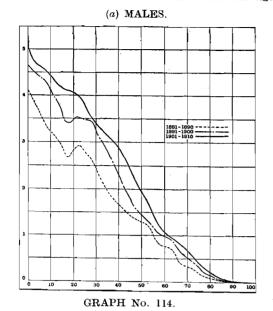
Decennium.					Males.	Females.	Persons.		
1881-90 1891-1900 1901-10	••	••	•••		1,454,549 1,851,448 2,110,880	1,235,961 1,632,900 1,941,704	2,690,510 3,484,348 4,052,584		

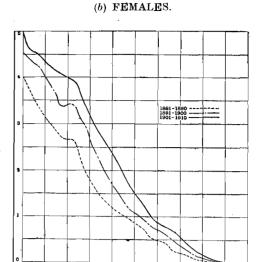
The following table furnishes particulars in respect of the number of years of life in each age-group experienced in the Commonwealth during each of the three decennia, the data being given separately for males and females.

Years of Life Experienced in each Age-Group,-Commonwealth, 1881-1910.

Age Last	Вівтні	DAY.		MALES.		Females.				
			1881-90.	1891–1900.	1901–10.	1881–90.	1891–1900.	1901–10.		
			Years.	Years.	Years.	Years.	Years.	Years.		
0-4			1,934,296	2,266,841	2,404,042	1,873,270	2,207,555	2,341,884		
5-9			1,705,111	2,150,204	2,280,879	1,659,732	2,090,313	2,231,771		
l014			1,540,076	1,949,120	2,144,893	1,495,115	1,905,860	2,114,382		
l <b>5</b> –19			1,373,925	1,729,319	2,054,228	1,362,174	1,712,270	2,027,612		
20-24			1,434,694	1,752,316	1,982,643	1,303,923	1,681,510	1,952,613		
25–29		• • •	1,323,928	1,712,607	1,792,528	1,026,672	1,481,427	1,714,789		
30-34			1,086,392	1,513,769	1,626,595	803,454	1,202,868	1,470,499		
35–39			900,241	1,280,532	1,511,942	650,402	962,376	1,285,819		
10-44			771,665	1,025,074	1,341,240	551,015	766,996	1,081,703		
15 <u>–4</u> 9			678,404	797,422	1,091,850	470,505	592,894	855,948		
50-54			597,413	662,034	863,934	386,049	497,255	677,631		
55–59	• •		417,718	527,481	618,225	273,627	395,964	495,124		
60-64	• •		346,543	448,189	484,459	218,410	322,195	400,661		
35–69 ··			195,950	313,056	391,584	127,235	230,345	330,929		
70-74			132,029	213,646	269,600	86,645	148,884	218,009		
75–79			64,474	104,760	151,777	42,637	76,310	128,151		
30–84			31,069	48,741	71,124	20,236	37,729	62,352		
35–89			8,355	14,335	20,638	6,071	12,263	20,722		
00-94			2,437	3,949	5,164	1,845	3,223	5,239		
95–99			495	824	1,117	444	579	976		
00 and ove	r	• •	277	256	341	145	186	232		
ALL AGES			14,545,492	18,514,475	21,108,803	12,359,606	16,329,002	19,417,043		

## Years of Life at each Age, Commonwealth, 1881-1910.





GRAPH No. 115.

The accompanying graphs Nos. 114 and 115 represent the numbers of years of life experienced at each age, in each of the three decennia, 1881-1890, 1891-1900, 1901-1910, the former relating to males, the latter to females. In each case the base of a small square represents 10 years of age, while the vertical height represents 50,000 years of life experienced.

The life experience for males and females separately in New South Wales in each of the three decennia was as follows:—

Years of Life Experienced in each Age-Group,-New South Wales 1881-1910.

AGE LAST B	IRTHI	DAY.		MALES.			FEMALES.	
			1881–90.	1891–1900.	1901–10.	1881-90.	1891–1900.	1901–10
			Years.	Years.	Years.	Years.	Years.	Years.
0-4	• •	• •	700,851	837,322	911,000	675,147	816,563	876,299
5–9	• •	• •	614,856	792,722	856,901	596,319	772,231	825,599
0-14	• •	• •	539,948	720,939	815,290	519,095	706,050	792,608
5-19	• •	• •	463,899	626,641	772,932	455,437	626,151	755,530
20-24	• •	• •	491,385	610,865	747,573	432,355	593,850	730,456
5-29	• •	• •	469,478	594,127	663,456	350,530	517,655	634,884
30-34	• •		401,267	533,364	587,482	282,008	417,206	527,189
35–39	• •		339,112	466,575	544,810	229,573	341,041	457,829
ŀ0 <b>−44</b>			281,775	381,963	484,007	185,218	275,362	380,049
5-49			233,629	304,135	399,222	149,830	213,112	301,170
60 <b>–54</b>		• •	192,211	244,580	322,624	115,162	170,301	241,188
55–59			126,611	183,726	235,527	80,937	130,080	178,860
60-64			104,484	147,156	185,056	65,798	98,414	140,809
55–69			61,080	98,824	142,985	39,530	69,115	109,482
′0–7 <b>4</b>			42,516	63,800	91,904	27,837	44,188	67,23
75–79			22,171	32,378	50,304	14,005	23,605	39,18
80-84	٠.		11,523	15,909	22,929	6,511	12,039	18,679
15–89			3,079	4,957	6,676	1,865	3,906	6,340
00-94			940	1,595	1,807	556	1,068	1,837
5-99			174	344	434	193	265	289
.00 and over	••		154	122	152	84	59	70
ALL AGES		[	5,101,143	6,662,044	7.843.071	4,227,990	5,832,261	7,085,60

The next table furnishes the Victorian life experience for each sex and age-group in each of the three decennia:—  $\cdot$ 

Years of Life Experienced in each Age-Group.—Victoria, 1881-1910.

Age Last B	IRTHI	DAY.		MALES.		Females.				
			1881–90.	1891–1900.	190110.	1881–90.	1891–1900.	190110.		
			Years.	Years.	Years.	Years.	Years.	Years.		
0-4		]	651,264	716,994	677,455	632,349	704,728	668,914		
5-9	٠,		592,327	690,036	671,927	579,199	674,843	667,923		
10–14	. 7		561,288	633,073	638,286	551,607	625,334	640,976		
15–19			525,968	584,031	614,103	535,919	593,398	629,207		
20-24			503,681	579,045	543,832	511,226	609,402	606,564		
25–29			427,300	552,408	472,347	388,087	547,880	537,237		
30-34			334,014	476,573	447,113	294,067	441,863	480,459		
35–39		}	269,636	391,719	431,374	235,125	346,649	435,991		
40-44			250,404	304,562	386,053	211,620	273,150	373,678		
<b>45–4</b> 9		]	255,859	232,475	310,787	193,889	208,922	292,356		
50-54			247,960	208,579	239,311	169,245	187,915	228,470		
5 <b>5</b> –59			186,296	191,413	168,111	120,771	159,264	165,481		
60-64			155,208	178,776	140,921	94,697	137,110	141,972		
65-69			82,805	135,840	136,018	52,122	103,598	131,775		
70–74			52,004	94,599	104,292	34,759	65,116	90,319		
75–79		.,	23,892	44,373	62,797	16,540	32,065	54,311		
80-84		\	10,791	19,068	30,399	7,831	15,132	26,522		
85–89			3,007	5,335	8,251	2,409	4,688	8,286		
90–94			867	1,387	1,876	743	1,193	1,873		
95–99			183	264	308	164	196	399		
100 and over	• • •	••	84	82	97	21	78	108		
ALL AGES			5,134,838	6,040,632	6,085,658	4,632,390	5,732,524	6,182,818		

The Queensland data in respect of life experience in each sex and age-group are as follows:

Years of Life Experienced in each Age-Group.—Queensland, 1881-1910.

Age	Last B	(RTHI	DAY.		Males.		Females.				
				1881–90.	1891–1900.	1901–10.	1881–90.	1891–1900.	190110.		
				Years.	Years.	Years.	Years.	Years.	Years.		
0-4				240,578	310,189	335,647	228,490	305,806	326,067		
5–9				194,557	275,530	314,340	185,793	269,055	307,865		
10-14			]	164,836	240,617	295,753	154,408	235,522	292,722		
l <i>5</i> –19				144,697	210,625	274,763	129,145	198,546	260,868		
20-24				188,758	246,106	283,992	135,127	200,259	245,493		
25 - 29			]	199,835	250,970	258,759	110,265	171,741	203,766		
30 - 34				167,633	221,955	233,064	87,744	139,731	172,539		
35–39			]	140,601	187,158	216,703	72,565	109,110	148,924		
40–44				119,861	151,660	190,483	57,986	86,361	122,994		
45-49				88,737	118,019	154,786	44,857	67,491	94,298		
<b>5054</b>				68,583	97,387	123,075	32,627	53,291	74,780		
55–59				38,468	66,489	89,256	20,381	38,591	54,846		
60-64				26,636	50,630	70,363	14,185	28,709	43,285		
65 – 69				13,318	28,613	48,702	7,892	17,058	31,343		
70-74				7,752	16,083	31,022	4,769	10,223	19,766		
75–79		• •.		3,512	7,193	14,522	2,129	4,812	10,022		
80-84				1,465	3,136	5,863	920	2,263	4,494		
85–89				348	781	1,620	304	697	1,520		
90 - 94				79	187	372	107	169	349		
95 – 99				40	64	77	18	43	76		
100 an	d over	• •	••	• •	8	19		13	29		
ALL	AGES.			1,810,294	2,483,400	2,943,181	1,289,712	1,939,491	2,416,046		

The number of years of life experienced in South Australia, is given in the next table for each sex and age-group in each of the three decennia:—

Years of Life Experienced in each Age-Group.—South Australia, 1881-1910.

Age I	ast E	BIRTHI	DAY.		MALES.		Females.				
				1881–90.	1891–1900.	1901–10.	1881–90.	1891–1900.	1901–10		
				Years.	Years.	Years.	Years.	Years.	Years.		
0-4				222,756	221,556	212,379	218,871	216,578	210,502		
5–9				197,211	226,582	209,663	195,590	223,833	209,633		
l <b>0–14</b>				178,275	209,213	202,726	176,287	204,396	202,138		
l 5–19				152,942	178,018	200,089	156,368	180,757	203,428		
20 - 24				164,686	162,469	182,849	146,691	164,777	186,085		
25-29				149,774	143,712	156,631	116,917	138,452	159,040		
30-34				122,944	134,478	134,977	92,437	117,126	131,988		
35-39				103,002	115,377	118,090	75,698	98,308	114,629		
10-44				78,160	97,763	111,689	63,245	79,881	101,489		
15-49				62,950	79,767	94,451	53,272	64,566	83,817		
50 - 54				52,070	61,305	79,293	44,479	53,390	67,052		
55–59		• • •		37,387	47,417	60,924	32,788	42,492	51,921		
30-64				31,483	38,054	43,608	27,610	36,808	42,149		
35–69	. •			19,883	26,487	32,898	17,881	26,236	32,967		
70-74				14,063	20,124	23,378	12,133	19,118	24,299		
75–79				6,901	10,690	13,519	6,326	10,474	14,844		
80-84				3,124	5,233	6,993	3,093	5,399	8,060		
35–89				857	1,595	2,296	990	1,982	2,945		
90-94				169	315	523	262	505	765		
5-99				29	47	104	48	54	126		
00 an	d ove	r		••	13	20	20	21	14		
$\mathbf{A}_{\mathbf{L}\mathbf{L}}$	Ages	••	· [	1,598,666	1,780,215	1,887,100	1,441,006	1,685,153	1,847,891		

The Western Australian experience in each sex and age-group for each of the three decennia was as follows:—

Years of Life Experienced in each Age-Group.—Western Australia, 1881-1910.

Age L	ast Bi	RTHD	AY.		MALES.		Females.				
•				1881-90.	1891-1900.	1901–10.	1881-90.	1891–1900.	1901–10.		
				Years.	Years.	Years.	Years.	Years.	Years.		
0-4				25,943	73,264	141,179	26,174	59,327	141,514		
5-9				22,236	60,991	119,046	21,656	48,810	120,307		
0-14				20,288	51,950	97,403	20,154	42,168	98,324		
5-19				17,903	48,984	95,274	17,675	34,944	85,164		
20-24				21,268	77,459	137,521	16,050	40,158	93,810		
<b>25–2</b> 9				21,499	97,653	165,614	12,721	42,588	102,541		
30-34				16,360	85,171	160,217	9,854	34,528	93,941		
35-39				13,987	66,845	144,894	7,846	24,750	77,851		
10-44				12,509	47,069	114,716	6,821	16,917	56,420		
5-49				12,293	31,944	79,208	5,577	11,938	38,414		
60-54				11,495	24,992	53,387	4,238	9,799	27,161		
55-59				8,253	18,856	32,613	3,067	7,184	18,198		
60-64				7,072	15,379	23,101	2,299	5,168	13,814		
5-69				3,619	9,305	14,970	1,192	3,039	9,430		
0-74				2,564	6,296	9,183	880	1,908	5,324		
5-79				969	2,398	4,300	357	825	2,489		
80-84				385	1,029	1,969	177	383	961		
35-89				90	251	461	52	146	390		
0-94				38	67	138	17	41	63		
5-99					4	19		3	11		
00 and	l over	:		4	10	. 4	••		8		
ALL .	Ages			218,775	719,917	1,395,217	156,807	384,624	986,138		

In Tasmania the number of years of life experienced in each sex and age-group in each of the three decennia was as follows:—

Years of Life Experienced in each Age-Group.—Tasmania, 1881-1910.

Age Las	т Віктн	DAY.		MALES.		FEMALES.				
			1881–90.	1891–1900.	190110.	1881-90.	1891–1900.	1901–10.		
-			Years.	Years.	Years.	Years.	Years.	Years.		
0-4			92,904	107,516	126,382	92,239	104,553	118,588		
5-9			83,924	104,343	109,002	81,175	101,541	100,444		
0-14			75,441	93,328	95,435	73,564	92,390	87,614		
5–19			68,516	81,020	97,067	67,630	78,474	93,415		
20-24			64,916	76,372	86,876	62,474	73,064	90,205		
25 <b>–2</b> 9			56,042	73,737	75,721	48,152	63,111	77,321		
30–34			44,174	62,228	63,742	37,344	52,414	64,383		
5–39	• •	• •	33,903	52,858	56,071	29,595	42,518	50,595		
0-44	• •		28,956	42,057	54,292	26,125	35,325	47,073		
<b>5–4</b> 9	• •		24,936	31,082	53,396	23,080	26,865	45,890		
60-54			25,094	25,191	46,244	20,298	22,559	38,980		
55–59	• •		20,703	19,580	31,794	15,683	18,353	25,812		
60–64	• •	• •	21,660	18,194	21,410	13,821	15,986	18,632		
5-69		• ••	15,245	13,987	16,011	8,618	11,299	15,932		
0-74	• •	• •	13,130	12,744	9,821	6,267	8,331	11,068		
5-79	• •	• •	7,029	7,728	6,335	3,280	4,529	7,296		
80-84	• •	• •	3,781	4,366	2,971	1,704	2,513	3,636		
35–89	• •	• •	$\bf 974$	1,416	1,334	451	844	1,241		
0-94	• •	• •	344	398	448	160	247	352		
5–99	• •	• •	69	101	175	21	18	75		
00 and o	ver	••]_	35	21	49	20	15	••		
ALL AG	ES		681,776	828,267	954,576	611,701	754,949	898,552		

(c) Computation of Death Rates.—Having obtained the number of deaths in each agegroup which occurred during a decennium, and also the years of life experienced during the decennium by the community in which those deaths arose, the division of the former by the latter gives what has been termed the "central death rate" for each age-group, and furnishes a very good rough measure of the rate of mortality of the community. The term "central death rate" has been applied because the rate thus obtained for any age-group represents approximately the instantaneous rate of mortality per annum experienced at the centre of the age-group. In several cases of life table construction this computation has been made use of, and the values so obtained have been taken as representing the death rates for ages at quinquennial intervals, the rates for intermediate ages being supplied by interpolation. For ages between 5 and 65 such a method gives fairly satisfactory results, but for the extremes of infancy and old age where the rates change rapidly with the age, the assumption that the central death rate for an age-group represents the rate for the central age of the group is not warranted. To obviate this difficulty the method originally employed by Milne in the construction of the Carlisle table has been extensively used. The basic principle of this method is that of allocating to single ages, by a graphic process, the data available for deaths and years and life in respect of age-groups. The division of the former series by the latter gives for each age the central death rate, which, for any age x is usually represented by the symbol  $m_x$ . From this all the other life table functions can be readily computed. A variation of this method was suggested by Mr. J. M. Allen, F.I.A., in a paper read before the Institute of Actuaries, London, on 25th March, and published in Volume XLI., p. 305, of the Journal of the Institute. A feature of this modified method is that while simple in application it gives directly for each age one of the theoretically most important life table functions, viz., the instantaneous rate of mortality, or as it is more usually called, the "force of mortality." This function, which for any age x is usually denoted by the symbol  $\mu_x$ , represents the annual rate at which the community under review is dying at the moment of attaining age x. The principle on which Mr. Allen's method is based may be stated briefly as follows:

As  $l_x$  denotes the number of persons attaining the age x and  $\mu_x$  denotes the death rate to which they are subject at the moment of attainment, the number of deaths between the ages of x and x+5 may be represented by the integral  $\int_x^{x+5} l_x \mu_x dx$ . If, therefore, the statistics of deaths according to age be plotted with ages as abscissæ, and the number of deaths in age-groups as rectangles be erected in the appropriate places thereon, the drawing of an equivalent continuous curve through the upper parts of these rectangles will furnish a convenient basis for determining the value of the product  $l_x \mu_x$  at each age, since all that is necessary is to read off for each age the value of the ordinate to the curve so drawn. Similarly, since  $l_x$  denotes the number of persons who attain the exact age x, the number of years of life experienced in the community between the ages of x and x+5 may be represented by the integral  $\int_x^{x+5} l_x dx$ . Hence with statistics of years of life in age-groups, a curve representative of the life experience may be readily drawn, the values of the ordinates of which will give the values of  $l_x$ . Having thus determined the values of  $l_x \mu_x$  and  $l_x$  for each integral value of x, the division of the former series by the latter gives the value of  $\mu_x$  the force of mortality, for each integral age. In practice it will usually be found that though the curves which give  $l_x \mu_x$  and  $l_x$  have been drawn with every care, the results

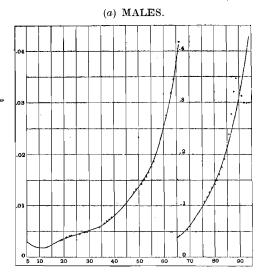
obtained by dividing the former series of values by the latter will present minor irregularities, which may readily be removed by a process of graphic graduation before proceeding to the computation of the other life table functions. Owing to rapid changes in the rate of mortality during the first few years of life it is difficult to satisfactorily draw the curves for  $l_x\mu_x$  and  $l_x$  through the portion relating to these earlier years, and better results may be obtained by making use of statistics of births to compute the rates of mortality for the first five years. The process indicated above may consequently be considered as applying to the period of life from age 5 onwards, that relating to the first five years will be discussed in latter sub-sections. For the construction of the tables contained in pp. 1207 to 1278 of Volume III., the data contained in sub-sections (a) and (b) above were plotted and graduated, and the values of  $\mu_x$  were then obtained by division. These values were then subjected to a process of graphic graduation, the graduated results being tested throughout and amended where necessary to give results which combined regularity of progression with goodness of fit. As an example of the change effected by the process of graduation the following table gives for ages 5 to 94 the computed and the adjusted values of  $\mu_x$  for the Commonwealth Life Tables for males and females for the decennium 1901-1910:—

Computed and Adjusted Values of  $\mu_x$ —Commonwealth, 1901-10.

	Ma	LES.	Fem	ALES.			MA	LES.	FEMALES.		
Age.	$\mu_x$ Computed	$\mu_{m{x}}$ Adjusted.	$\mu_x$ Computed	$\mu_x$ Adjusted.	AGE	i.	$\mu_x$ Computed	$\mu_{m{x}}$ Adjusted.	$\mu_x$ Computed	$oldsymbol{\mu_x}{ ext{Adjusted}}$	
5	.0029	.0029	.0027	.0027	50		.0138	.0137	.0097	.0094	
6	.0025	.0025	.0023	.0023	51	::	.0143	.0144	.0098	.0098	
7 7	.0022	.0022	.0020	.0020	$5\overline{2}$		.0150	.0151	.0101	.0103	
	.0021	.0020	.0018	.0018	53		.0157	.0159	.0106	.0109	
9	.0019	.0019	.0017	.0017	54		.0165	.0168	.0112	.0116	
Ď	.0018	.0018	.0016	.0016	55		.0175	.0178	.0121	.0124	
i	.0018	.0018	.0016	.0016	56		.0187	.0189	.0131	.0133	
2	.0018	.0018	.0016	.0017	57		.0201	.0202	.0143	.0143	
3	.0019	.0019	.0017	.0018	58		.0216	.0217	.0155	.0155	
i	.0021	.0021	.0019	.0019	59		.0234	.0234	.0169	.0169	
· · · · · · · · · · · · · · · · · · ·	.0024	.0024	.0022	.0021	60		.0255	.0252	.0184	.0185	
6	.0027	.0027	.0024	.0023	61		.0275	.0272	.0200	.0203	
7	.0029	.0029	.0026	.0026	62		.0294	.0294	.0219	.0222	
·	.0031	.0032	.0028	.0028	63		.0317	.0318	.0240	.0243	
9	.0033	.0034	.0030	.0030	64		.0344	.0345	.0264	.0266	
)	.0036	.0036	.0033	.0032	65		.0380	.0376	.0292	.0291	
	.0039	.0038	.0035	.0034	66		.0418	.0412	.0322	.0318	
	.0041	.0040	.0037	.0036	67		.0457	.0453	.0350	.0348	
	.0042	.0041	.0038	.0038	68		.0496	.0499	.0378	.0381	
4	.0042	.0041	.0039	.0040	69		.0539	.0550	.0410	.0419	
_	.0044	.0044	.0041	.0042	70		.0592	.0606	.0455	.0464	
0	.0045	.0046	.0044	.0044	71	<i></i>	.0662	.0667	.0519	.0516	
-	.0047	.0047	.0046	.0046	72		.0737	.0734	.0584	.0575	
1	.0048	.0049	.0048	.0048	73		.0812	.0808	.0647	.0639	
^	.0049	.0050	.0050	.0050	74		.0892	.0887	.0711	.0706	
9	.0051	.0051	.0051	.0051	$7\hat{5}$		.0981	.0969	.0772	.0775	
i	.0053	.0053	.0052	.0053	76		.1071	.1052	.0842	.0845	
2	.0054	.0055	.0053	.0055	77		.1165	.1138	.0919	.0917	
3	.0056	.0057	.0055	.0057	78		.1256	.1229	.1003	.0992	
i	.0058	.0059	.0057	.0059	79		.1343	.1326	.1083	.1072	
5	.0062	.0062	.0061	.0061	80		.1423	.1430	.1143	.1157	
5	.0066	.0065	.0065	.0063	81		.1492	.1540	.1198	.1250	
7	.0070	.0068	.0068	.0065	82		.1606	.1660	.1278	.1350	
3	.0073	.0072	.0070	.0067	83		.1749	.1800	.1390	.1460	
9	.0077	.0076	.0071	.0069	84		.1902	.1950	.1548	.1580	
j	.0081	.0080	.0071	.0071	85		.2109	.2110	.1763	.1720	
í.,	.0085	.0084	.0072	.0073	86		.2397	.2280	.2014	.1880	
2	.0089	.0089	.0073	.0075	87		.2782	.2460	.2305	.2060	
3	.0094	.0094	.0075	.0077	88		.3206	.2660	.2615	.2250	
i	.0100	.0100	.0078	.0078	89		.3469	.2880	.3018	.2450	
· · · · · · · · · · · · · · · · · · ·	.0106	.0106	.0081	.0080	90		.3494	.3120	.3267	.2660	
,	.0112	.0112	.0084	.0082	91		.3132	.3380	.3088	.2890	
,	.0119	.0118	.0088	.0084	$9\overline{2}$		.2995	.3660	.2896	.3140	
,	.0126	.0124	.0091	.0087	93		.2992	.3960	.2947	.3410	
,	.0132	.0130	.0094	.0090	94		.2998	.4280	.3090	.3700	

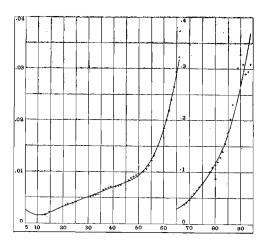
It will be seen that for all ages up to 85 the deviations of the adjusted from the computed values were small, and tended to counterbalance each other. Beyond 85, however, the computed values being based on data of very limited extent, were marked by considerable irregularity. As there is further much uncertainty concerning the particulars furnished at these higher ages in respect both of the living and the dead, it was deemed advisable to arbitrarily project the curve graphically to age 98 as a reasonable continuation of the curve to 85, and to so determine the final values of  $q_x$ , the probability of dying within a year at age x, that from 96 to 104, these values should be a series of the third degree, having the value 1 at age 104. Owing to the small experience at the higher ages, the method of dealing with the data for these ages has little effect on the expectation of life computed for the earlier ages, and the methods employed appear as reasonable and satisfactory as any which could be adopted.

### Computed and Adjusted Values of $\mu_x$ . Commonwealth, 1901-10.



GRAPH No. 116.





GRAPH No. 117.

Graphs Nos. 116 and 117 furnish a graphic representation of the nature and extent of the deviation of the adjusted values of  $\mu_x$  from the computed values of that function for ages 5 to 94. Graph No. 116 relates to the male and No. 117 to the female experience. The base of each small rectangle represents 5 years of age, while the vertical height represents in each graph an increment of .005 in the value of  $\mu$ , for the left hand curve, and an increment of .05 in the value of  $\mu$ , for the right hand curve. In each case the continuous line represents the adjusted values, while the series of crosses denote the positions occupied by the computed values where these deviate perceptibly from the adjusted values.

Since 
$$\mu_x = -\frac{1}{l_x}$$
,  $\frac{d\,l_x}{dx} = -\frac{d\,\log_e\,l_x}{dx}$ , it follows that  $\int_0^1\!\!\!\mu_{x+t}dt = \log_e\,l_x - \log_e\,l_{x+1}$ 

 $=-\log_e p_x=\operatorname{colog}_e p_x$ . Hence, from a series of values of  $\mu_x$  for successive ages the corresponding values of  $\operatorname{colog}_{10} p_x$  may readily be computed by a method of approximate summation. In the construction of the tables under review the summation formula employed was

$$\int_{1}^{2} f(x+t) dt = \frac{1}{24} \left\{ 13 \left[ f(x+1) + f(x+2) \right] - \left[ f(x) + f(x+3) \right] \right\}$$

a formula which lends itself readily to application in columnar form, and to appropriate checks at each stage of the work (see note B, p. 346). As the division by 24 indicated in the formula gives the value of  $\operatorname{colog}_{t} p_x$ , it is necessary to multiply by the logarithmic modulus (.4342945) to obtain  $\operatorname{colog}_{10} p_x$ . Instead of dividing by 24 and then multiplying by .4342945, the simpler course of multiplying at once by .018096 was adopted, the operation being performed by means of the "millionaire" calculating machine. From the values of  $\operatorname{colog}_{10} p_x$  the values of  $\operatorname{log}_{10} p_x$  those of  $\operatorname{log}_{10} l_x$  were derived from the relation  $\operatorname{colog}_{10} p_x = -\log_{10} p_x$ , and from the values of  $\operatorname{log}_{10} p_x$  those of  $\operatorname{log}_{10} l_x$  were derived from the relation  $\operatorname{log} l_{x+1} = \operatorname{log} l_x + \operatorname{log} p_x$ . The initial value of  $l_x$  at age 0 was arbitrarily chosen as 100,000. Having determined the values of  $l_x$  from those of  $\operatorname{log} l_x$  the values of  $\operatorname{log} p_x$ , and the values of  $q_x$  from the relation  $q_x = l_x - l_{x+1}$ . The values of  $p_x$  were obtained from those of  $\operatorname{log} p_x$ , and the values of  $p_x$  from the relation  $p_x$  the number surviving each age, the values of  $p_x$ , the number of years of life experienced between ages  $p_x$  and  $p_x$  and  $p_x$  the values of the relation  $p_x$  the number of years of life experienced between ages  $p_x$  and  $p_x$  and  $p_x$  the values of the relation

 $L_x = \int_x^{t+1} dx$ , the formula of approximate summation given above being employed. In practice

the application of this formula leaves a term at either end undetermined. To supply this deficiency the following formulas were used, viz.:—

$$\int_{0}^{1} f(x+t) dt = \frac{1}{24} \left\{ 9f(x) + 19f(x+1) - 5f(x+2) + f(x+3) \right\}$$

From  $L_x$ , by summing from the highest age backwards, the column of values of  $T_x$  was formed, representing, from one point of view the aggregate future lifetime of the  $l_x$  persons who reach the age x, and from another point of view the number of persons aged x and upwards in a stationary population maintained by  $l_0$  births annually. The division of  $T_x$  by  $l_x$  gives the complete expectation of life at age x, which is denoted by  $e_x$ , and which represents the average future lifetime of the persons who attain age x. As a supplementary check on the

calculations involved in the construction of the tables, the value of what is known as the "curtate" expectation of life was computed by means of the formula  $e_x = p_x (1 + e_{x+1})$ . Here  $e_x$  represents the average number of completed years of life lived by the  $l_x$  persons who attain age x, and as each person on the average lives approximately half a year in the year of death, the "complete" expectation of life is approximately equal to the curtate expectations half a year. To be strictly accurate the relation between the complete and the curtate expectations is represented by the formula  $\dot{e}_x = e_x + \frac{1}{2} - \frac{1}{12} \mu_x$ . The figures obtained separately for  $\dot{e}_x$  and  $e_x$  were compared and found in close accord with the formula throughout. Finally the central death rate for each age was computed by means of the relation  $m_x = d_x \div L_x$ . This is a function which is not usually tabulated in life tables, but owing to the increasing tendency amongst actuaries to employ it in investigations concerning complicated benefits, such as those relating to pension funds, superannuation schemes and friendly societies, as well as in other cases where mortality is only one of several decremental forces simultaneously in operation, it has appeared desirable to tabulate it in all cases.

It may further be noted that as the latter portion of each table from age 98 onwards was completed by an arbitrary continuation to age 104 of the curve representing  $q_x$ , it became necessary, in order to complete the table of  $\mu_x$  to the oldest age, to compute for this latter function the values corresponding to those determined for  $q_x$ . This was done by means of the approximate relation  $\mu_{x+1}=2$  colog<sub>e</sub>  $p_x-\mu_x$ .

The value of  $\mu_x$  being known for age 98, and the values of  $\operatorname{colog}_e p_x$  being determinable for all ages from 98 onwards, the values of  $\mu_x$  were readily computed for ages 99 to 104.

In the graphic graduation of  $\mu_x$  the test applied for smoothness was that of securing regularity of progression in the successive differences of the values ascertained. Goodness of fit was tested by computing the values of  $l_x \mu_x$  with the adjusted values of  $\mu_x$ , and ascertaining the successive deviations and accumulated deviations from the values of  $l_x \mu_x$  obtained from the death curve. By these means a curve was obtained which, while reasonably smooth throughout, was yet in close accord with the data. As a further test of goodness of fit, the number of years of life experienced at each age during the decennium was roughly computed by means of the approximate relation  $L_x = \frac{1}{2} (l_x + l_{x+1})$ , the values of  $L_x$  so obtained being multiplied by the final values of  $m_x$  to obtain for each age the expected deaths in each year of age according to the table under review. A comparison for quinquennial ages of the expected deaths so obtained with those furnished by the actual data, is given in the succeeding table for the Commonwealth Male and Female Life Tables, for the decennium 1901-10, ages 5 to 99.

Expected and	Actual	Deaths.—Commonwealth	Life	Tables,	1901-10.
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			Ма	LES.		FEMALES.				
AGE L BIRTHI		Expected Deaths.	Actual Deaths.	Devia- tion.	Accum- lated De- viation.	Expected Deaths.	Actual Deaths.	Devia- tion.	Accum- ulated De- viation.	
5-9		5,055	5,066	11	- 11	4,483	4,496	— <u>13</u>	- 13	
10-14	• •	4,131	4,108	+ 23	+ 12	3,723	3,614	+ 109	+ 96	
15-19 $20-24$	• • •	$6,259 \\ 8,009$	$6,169 \\ 8,119$	$+ 90 \\ - 110$	$+\frac{102}{8}$	$5,402 \\ 7,199$	$5,521 \\ 7,219$	$\begin{array}{c c} - & 119 \\ - & 20 \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
25=29	• •	8,571	8,487	+ 84	$\begin{array}{c c} - & 6 \\ + & 76 \end{array}$	8,032	8,024	+ 8	— 45 — 35	
30-34		9,127	8,983	+ 144	+ 220	8,236	7,933	+ 303	+ 268	
35-39		10,620	10,788	-168	+ $52$	8,452	8,672	-220	+ 48	
40-44		12,278	12,314	<b>— 3</b> 6	+ 16	8,169	8,070	+ 99	+ 147	
45 - 49		13,196	13,346	150	<b>— 134</b>	7,348	7,617	269	122	
50-54		13,327	13,149	+ 178	+ 44	7,163	7,076	+ 87	35	
55-59		12,966	12,925	+ 41	+ 85	7,475	7,410	+ 65	+ 30	
60-64		14,944	14,994	<b>—</b> 50	+ 35	9,275	9,187	+ 88	+ 118	
65-69	• •	18,499	18,436	+ 63	+ 98	12,032	11,975	+ 57	+ 175	
70-74		20,459	20,445	+ 14	+ 112	13,169	13,241	— <u>72</u>	+ 103	
75–79	• •	17,705	17,978	-273	— 161	12,007	12,018	- 11	+ 92	
80-84	• •	12,017	11,700	$+\ 317$	+ 156	8,607	8,297	+ 310	+ 402	
85–89	• • •	5,101	5,649	548	— 392	4,226	4,732	506	- 104	
90-94	• •	1,871	1,579	+ 292	- 100	1,588	1,542	+ 46	_ 58	
9 <b>5–9</b> 9	••	627	413	+ 214	+ 114	492	402	+ 90	+ <b>32</b>	
TOTAL,	5-99	194,762	194,648	$-{+ 114}$		137,078	137,046	+ 32		

It will be seen that the changes in sign of the deviation and the accumulated deviation are numerous for both sexes, and that the numerical values are relatively small throughout, thus indicating a closeness of accord between the graduated results and the original data. For the range from 5 to 99 the accumulated deviation represents less than 6 per 10,000 of the observed facts in the case of males and less than  $2\frac{1}{2}$  per 10,000 in the case of females.

(d) Infantile Ages.—As indicated above, the method employed for calculating the rates of mortality for ages under 5 years differed from that applied to ages above 5 years, the basis in this case being the birth experience from which the deaths during the decennium under review In most statistical publications the death rate of children under one year of age for any given year is obtained by dividing the number of deaths of children under one year of age registered during the year, by the number of births registered during the year, the quotient For many purposes the rate so obtained gives the obtained being expressed as a ratio to 1000. infant mortality with a sufficient degree of approximation, but there are two circumstances involved which tend to vitiate the result to some extent, viz., (i.) a large number of the deaths under one year of age occurring in any year is drawn from children born in the preceding year; (ii.) neither birth nor death registrations for any year represent exactly the occurrences for that If the number of births remained fairly constant from year to year no appreciable error would be introduced, but where such constancy is not in evidence, some allowance for the overlapping is desirable. For this purpose, in the construction of the life tables under review, the mean of the number of births for the year of observation and the preceding year was taken as the birth basis for the deaths under one year registered in the year of observation.

It may be noted here, that the rate of infant mortality so obtained represents approximately the probability at date of birth of surviving one year, and consequently differs in nature from the crude death rate, which, being a ratio of deaths to years of life, is a weighted average value of  $m_x$  for all ages, whilst the rate of "infant mortality" is the value of  $q_x$  at age 0.

In accordance with what has been stated above, the birth basis for, say, the decennium 1901-10, was taken as half the births registered in 1900, all the births registered in the years 1901 to 1909 and half the births registered in 1910. The division of the number of deaths at age 0 during the decennium by the number of births so deduced, gives the rate of mortality at age 0, that is, gives the proportion of children born alive who will fail to survive age 1, on the basis of the experience of the decennium.

To determine the rate of mortality for age 1 a new birth basis is required. This may be obtained from the consideration that the number of deaths of children aged one last birthday represents those who have survived the first year of life, but have failed to survive the second. The birth basis for computation in this case will thus extend a year farther back than in the case of deaths at age 0, and will consequently be obtained by adding to half the births for 1899, the whole of the births for 1900 to 1908 inclusive, and half the births for 1909. A similar procedure is required for each of the other ages at death, the basis for deaths at age 4 last birthday extending as far back as the births for the year 1896. It will thus be seen that for the three decennia from 1881 to 1910, the birth statistics from 1876 to 1910 inclusive were required. These are given in the succeeding table:—

Australian Births Registered, 1876 to 1910.

Year. N		N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	C'wlth
		_'	and other sections	MALES.	3			W. T.
876		11,791	13,759	3,540	4,134	474	1,660	35,35
O = =		12,292	13,272	3,702	4,382	459	1,645	35,75
0 <b>m</b> 0		13,082	13,752	3,769	4,801	438	1,798	37,64
0 = 0 "		13,840	13,727	4,000	5,013	528	1,774	38,88
000		14,424	13,358	4,171	5,398	448	1,884	39,68
0.04		14,891	13,903	4,242	5,522	533	2,029	41,12
000		15,087	13,612	4,414	5,589	572	2,069	41,34
000		16,014	14,109	5,093	5,677	541	$2,\!235$	43,66
004		17,417	14,844	5,399	6,051	564	2,327	46,60
		17,939	15,455	5,908	6,070	623	2,368	48,36
000		18,700	15,753	6,369	5,711	787	2,413	49,73
00=	••	18,901	16,876	6,929	5,666	791	2,444	. 51,60
000	· · · · ·	19,616	17,617	7,299	5,501	786	2,373	53,19
000		19,335	18,713	7,449	5,286	825	2,438	54,04
000		19,887	19,175	7,788	5,222	761	2,466	55,29
007		20,386	19,598	7,506	5,491	938	2,510	56,42
000		20,532	19,405	7,738	5,241	959	2,584	56,45
000		20,822	18,823	7,356	5,455	1,042	2,699	56,19
004		19,993	17,501	7,207	5,423	1,109	2,470	53,70
~~=		19,877	17,372	7,604	5,423	1,192	2,432	53,90
000		18,691	16,460	7,086	5,110	1,435	2,373	51,15
00 H		10,000	16,013	7,277	4,897	2,036	2,485	51,69
000		18,723	15,435	7,083	4,580	2,574	2,409	50,80
0.00		18,613	15,785	7,128	4,852	2,636	2,415	51,42
0.00		18,964	15,834	7,599	4,660	2,789	2,494	52,34
001		19,149	15,876	7,281	4,687	2,946	2,570.	52,50
902		19,322	15,583	7,279	4,587	3,241	2,604	52,61
903		10,055	15,115	6,427	4,484	3,433	2,570	50,40
904		10,055	15,313	7,134	4,686	3,666	2,702	53,35
905	.,	20,000	15,523	6,978	4,514	3,862	2,812	53,89
000		01 000	15,716	7,280	4,617	4,043	2,792	55,5
907		01 004	15,986	7,451	4,689	3,962	2,797	56,48
908		01 00 5	16,071	7,677	4,949	3,993	2,818	57,11
909		00'101	16,096	7,954	5,235	3,884	2,849	58,48
910		00,000	16,412	8,260	5,423	3,855	2,888	60,20

Australian Births Registered, 1876 to 1910—continued.

	Year.		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	C'wlth.		
FEMALES.											
1070			11 507	10.010	- 0.00	4.000	444	1 400	99.005		
1876	• •	• •	11,507	13,010	3,363	4,090	444 453	$\substack{1,489\\1,566}$	33,903		
877	• •	• •	11,559	12,738	3,467	4,258			34,041		
1878	• •	• •	12,246	12,829	3,628	4,481	433	1,704	35,32		
1879	• •	• • •	13,093	13,112	3,870	4,889	449	1,790	37,203		
880	• •	• •	13,738	12,790	4,025	4,864	485	1,855	37,75		
881	• •	• •	14,102	13,242	3,978	5,186	487	1,889	38,884		
882	• •	• •	14,615	13,135	4,104	5,255	517	1,974	39,600		
883	• •	••	15,267	13,432	4,797	5,496	517	2,024	41,53		
1884	• •	• •	16,529	14,006	5,280	5,796	530	2,251	44,395		
1885	٠.	• • [	17,104	14,520	5,764	5,976	577	2,269	46,210		
1886			17,584	15,071	6,213	5,466	679	2,214	47,22'		
1887	• •	• •	18,335	16,167	6,584	5,165	766	2,292	49,30		
1888	• •	• •	18,909	16,886	6,948	5,009	732	2,404	50,88		
1889	• • .	• •	17,960	17,646	6,952	5,032	769	2,319	50,67		
1890	• •		19,073	18,403	7,619	5,142	800	2,347	53,384		
1891	• •	• • .	19,072	18,907	7,209	5,261	848	2,461 '	53,75		
1892			19,509	18,426	7,165	5,329	889	2,381	53,699		
1893		\	19,520	17,729	7,038	<b>5,2</b> 51	1,070	2,517	53,12		
1894			18,958	16,757	6,770	5,076	1,014	2,382	50,95		
1895			18,897	16,334	7,270	5,144	1,181	2,358	51,18		
1896			17,815	15,718	6,931	4,938	1,347	2,230	48,97		
1897			18,258	15,297	7,036	4,665	1,985	2,199	49,44		
1898			17,499	14,737	6,850	4,390	2,394	$2,\!171$	48,04		
1899			17,848	15,223	6,771	4,570	2,538	2,259	49,20		
1900			18,182	14,945	7,202	4,517	2,665	2,370	49,88		
1901			18,726	15,132	7,022	4,424	2,772	2,360	50,43		
1902			18,513	14,878	6,937	4,360	2,991	2,481	50,16		
1903		]	17,589	14,454	6,194	4,024	3,266	2,510	48,03		
1904			18,810	14,450	6,948	4,447	3,510	2,590	50,75		
1905			19,295	14,584	6,648	4,354	3,720	2,445	51,04		
1906			19,882	15,128	6,739	4,329	3,757	2,541	52,37		
1907			20,597	15,379	7.089	4,549	3,750	2,494	53,85		
1908			20,853	15,026	7,153	4,841	3,762	2,797	54,43		
1909			21,318	15,448	7,598	4,856	3,718	2,651	55,58		
1910			$\frac{22,076}{22}$	15,025	7,909	5,157	3,730	2,698	56,59		

From the birth statistics contained in the preceding table the birth bases for the computation of rates were derived in the manner indicated above. The bases so computed for the Commonwealth and each of its component States are shewn in the following table:—

Birth Bases for Computation of Infantile Rates, 1881-1910.

to v	st Birthday which Birth is is applic- able.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	C'wlth.
				MALE Decennium				
$egin{array}{c} 0 \\ 1 \\ 2 \\ 3 \\ 4 \end{array}$		175,055 169,577 163,562 156,990 150,232	157,148 151,747 147,322 143,587 140,788	59,082 55,548 52,059 48,681 45,652	56,383 56,335 55,848 54,856 53,425	6,627 6,321 5,999 5,659 5,337	22,871 22,248 21,628 20,942 20,166	477,166 461,776 446,418 430,715 415,600
				Decennium,	1891–1900.			
$0 \\ 1 \\ 2 \\ 3 \\ 4$		196,051 196,874 197,682 198,084 198,044	173,897 177,031 179,586 181,109 181,186	73,679 73,933 74,202 74,136 73,604	51,413 51,911 52,588 53,434 54,119	15,696 13,777 11,977 10,460 9,514	24,857 24,855 24,848 24,809 24,809	535,593 538,381 540,883 542,032 541,276
			-	DECENNIUM,	1901–10.			
0 1 2 3 4		204,816 200,689 197,322 194,574 192,078	157,402 156,958 156,484 156,179 156,565	73,391 72,647 71,937 71,553 71,369	47,489 46,916 46,541 46,460 46,811	36,352 35,195 33,862 32,189 29,922	27,205 26,791 26,369 26,009 25,644	546,655 539,196 532,515 526,964 522,389

Birth Bases for Computation of Infantile Rates, 1881-1910.—continued.

to w	st Birth hich Bi is is app able.	rth	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	C'wlth.
					FEMALE	is.			
					DECENNIUM	, 1881–90.			
0			166,811	149,701	56,442	53,384	6,217	21,737	454,292
1		• •	161,709	144,628	53,104	53,174	5,899	21,227	439,741
2	• •	• •	155,945	140,333	49,903	52,838	5,589	20,612	425,220
3 4	• •	••	149,225	136,589	46,685	52,120	5,284	19,899	409,802
4	••	••	142,798	133,845	43,701	50,979	5,009	19,174	395,506
					DECENNIUM,	1891–1900.			
0			186,003	165,802	70.451	49,453	14,999	23,317	510,025
ĭ			186,505	168,743	70.750	49,997	13.181	23,335	512,51
2			187,266	171,029	70,889	50,538	11,466	23,481	514,669
3			188,009	172,538	70,712	51,097	10,026	23,645	516,02
4	• •		187,933	172,649	70,127	51,611	9,082	23,683	515,08
		!		D	ECENNIUM,	901–10.			
0			195,712	149,464	69,883	45,021	34,444	25,403	519,927
ĭ			192,030	149,311	69,117	44,558	33,321	25,043	513,380
$\tilde{2}$			188,618	149,055	68,551	44,190	32,047	24,534	506,995
3			185,771	148,869	68,374	44,022	30,480	24,074	501,590
4	• •		183,569	149,123	68,443	44,385	28,393	23,770	497,683

As an example of the calculation of the life table values for infantile ages, the following table is given, shewing the particulars in respect of the Commonwealth as a whole for the decennium 1901-10:—

Computation of Values for Infantile Ages.—Commonwealth, 1901-10.

Age. for Computat		Computation of Rates.	Deaths Recorded during Decennium.	Probability at Date of Birth of Surviving $x$ Years and Dying in the $(x+1)^{th}$ Year.	Number Surviving at each Age out of 100,000 Born.	Probability of Surviving ing One Year at each Age.  (6)	Probability of Dying with in a Year at each Age.
				MALES.		-	,
0	.,	546,655	52,000	.09512	100,000	.90488	.09512
1		539,196	8,691	.01612	90,488	$.98219 \\ .99331$	.01781
2	• •	532,515 $526,964$	$\begin{array}{c} 3,167 \\ 2,045 \end{array}$	.00595 $.00388$	$88,876 \\ 88,281$	.99560	.00669 $.00440$
$egin{array}{c} 2 \\ 3 \\ 4 \\ \end{array}$		522,389	1,428	.00273	87,893	.99689	.00311
				FEMALES.			
0		519,927	41,364	.07956	100,000	.92044	.07956
ì	•••	513,380	7,858	.01531	92,044	.98337	.01663
$\tilde{2}$		506,995	2,884	.00569	90,513	.99371	.00629
2 3		501,590	1,856	.00370	89,944	.99589	.00411
4		497,683	1,420	.00285	89,574	.99682	.00318

The figures contained in columns (2) and (3) of this table are those given in tables of data on pp. 303, 324, and 325 above, while the division of the items in (3) by the corresponding items in (2) gives the items in column (4). The multiplication of each of these items by 100,000 would give the number dying in each year of age out of 100,000 born, the subtraction of which from an initial 100,000 at age 0 gives the number surviving at each age out of that number born, the results being shewn above in column (5). The division of each value in this column by the preceding value gives the probability of surviving a year at each age, shewn in column (6), while the subtraction of this latter from unity gives the probability of dying within a year at each age shewn in column (7). For the purpose of adjusting these crude results, and also of computing the values of the force of mortality at each age  $(\mu_x)$ , a graduation of the results by Makeham's second modification of Gompertz's formula was applied. For an account of this graduation see a paper on "Investigations concerning a law of infantile mortality," by C. H. Wickens, A.I.A. (Trans. Australasian Association for the Advancement of Science, Vol. XIV., p. 526). On

bringing together the results deduced in respect of the first five years of age, and those in respect of ages 5 and upwards, it was occasionally found that the junction was not quite satisfactory. In such cases the adjusted values for ages 4 and 5 were further adjusted so as to secure the desired smoothness without undue deviation from the recorded data.

- (e) Calculation of Monetary Tables.—The principal purposes served by the construction of mortality tables for any community are as follows:—
- (i.) To furnish a reliable index to the mortality experience of the community for any given period.
- (ii.) To furnish a basis for the comparison of the experience of the community for one period with that for another.
- (iii.) To furnish a basis for the comparison of the experience of the community with that of other communities.
- (iv.) To furnish a basis for the calculation of monetary tables for the valuation of payments dependent on the contingencies of human life.

The purposes indicated in (i.), (ii.) and (iii.) are amply provided for in the extensive series of tables published on pp. 1207 to 1278 of Volume III. of the Census Report, but it was felt that a series of monetary tables would be more servicable if published separately. It was also considered unnecessary in the compilation of monetary tables to use more than one mortality basis for each sex, that adopted being the experience of the Commonwealth as a whole for the decennium 1901-10. A series of single life tables has consequently been published in a royal octavo booklet of 80 pages and a companion series of joint life annuity tables is now in course of compilation. The monetary tables contained in the single life series comprise, for each sex, for the rates of interest 3 per cent.,  $3\frac{1}{2}$  per cent., 4 per cent.,  $4\frac{1}{2}$  per cent. and 5 per cent., the usual commutation columns, and the annual and continuous values for life annuities, single premiums, and annual premiums. For each sex a table of elementary values and a table of the values of temporary annuities at  $3\frac{1}{2}$  per cent. have also been added. In the joint life annuity tables in course of construction it is intended to include tables on two male lives, two female lives, and a male and female life. In the construction of the monetary tables on single lives the processes employed were briefly as follows:—The values of  $v^x$  (the present value of 1 due x years hence) were taken from Oakes's Interest Tables to 5 places of decimals, and were multiplied by the tabulated values of  $l_x$  to give for each age the value of  $D_x = v^x l_x$ , these results being retained true to the fifth significant figure, except that at the extremes of old age not more than five places of decimals were retained, thus cutting down the number of significant figures in such cases to four, three or even two.

The values of  $D_x$  were then summed from the oldest age upwards to give the values of  $\mathbf{N}_x$ , in accordance with the formula  $\mathbf{N}_x = \mathbf{D}_x + \mathbf{D}_{x+1} + \dots \dots$ , this form of the  $\mathbf{N}$  column being adopted to accord with the most recent practice in the publication of actuarial tables. The use of heavy type for  $\mathbf{N}$  instead of the open form frequently used was dictated by typographical considerations, the requisite type for the open form not being available. Similarly the column  $\mathbf{S}_x$  was constructed in accordance with the relation  $\mathbf{S}_x = \mathbf{N}_x + \mathbf{N}_{x+1} + \dots$  the  $\mathbf{N}$  column being summed from the bottom upwards.

In the same manner the C column was compiled from the relation  $C_x = v^{x+1} d_x$ , the M column from the relation  $M_x = C_x + C_{x+1} + \dots$  and the R column from the relation  $R_x = M_x + M_{x+1} + \dots$ 

In all cases appropriate checks on the accuracy of the computations were applied at successive stages, a closing check being the substantial accordance of the **S** and R columns with the relation  $R_x = v S_x - S_{x+1}$ .

The computation of the annuity values was carried out by means of the formula  $\mathbf{N}_x/\mathbf{D}_x=1+a_x$ , the calculations being performed in duplicate on the "millionaire." The quotients so obtained were carried to five places of decimals, and eventually cut down to three places for publication. The values of  $A_x$ , were computed by means of the relation  $A_x=1-d$   $(1+a_x)$  where d=1-v, and v as above denotes the present value of 1 due one year hence. The values of  $P_x$  were obtained from the relation  $P_x=A_x/(1+a_x)$ . The values in the A column were checked by means of the relation  $\Sigma A=n-d$   $\Sigma$  (1+a), where n denotes the number of terms in the a column. This and similar addition checks were carried out on the Burroughes Adding Machine. A further check of the A column, and a check of the P column were obtained from the relations  $A_x=\mathbf{M}_x/\mathbf{D}_x$  and  $P_x=\mathbf{M}_x/\mathbf{N}_x$ . A further test of the accuracy of the calculations was made by differencing the successive values of the several functions and observing the smoothness in the progression of the differences so obtained. In the case of the continuous values, those of  $\bar{a}_x$  were obtained from the relation  $\bar{a}_x=a_x+\frac{1}{2}-\frac{1}{12}(\mu_x+\delta)$ , where  $\delta$  denotes the "force" or instantaneous rate of interest (when i denotes the effective rate of interest per unit per annum,  $e^{\delta}=1+i$  and consequently  $\delta=\log_e(1+i)=\log_{10}(1+i)/\mathbf{M}$  where  $\mathbf{M}=43429...$ ). The column  $\bar{a}$  was checked by addition by means of the relation  $\Sigma \bar{a}=\Sigma a+n(\frac{1}{2}-\frac{1}{12}\delta)-\frac{1}{12}\Sigma\mu$ . The column  $\bar{a}$  was computed by means of the relation  $\bar{A}_x=1-\delta \bar{a}_x$ , and checked by addition by the relation  $\Sigma \bar{a}=n-\delta \Sigma \bar{a}$ . The column  $\bar{p}$  was computed by means of the relation  $\bar{p}_x=\bar{a}_x/\bar{a}_x$ , and checked by performing the calculations in duplicate. The test of smoothness in the progression of differences was also applied in all these cases.

LIFE TABLES.

In the case of the temporary annuity tables the relation  $a_{x\overline{n}|} = (D_{x+1} + D_{x+2} + \dots + D_{x+n})/D_x$  furnished a very convenient basis for rapid calculation on the millionaire calculating machine of the successive values required. For this purpose the values of  $D_x$  for all ages from 1 upwards were written on a movable slip, and the value of the reciprocal of each value of  $D_x$  was written at the head of the column for age x on the working sheet. This reciprocal was set up on the fixed plate of the millionaire, and was multiplied successively by the values of  $D_{x+1}$ ,  $D_{x+2}$ , etc., the product holes being left uncleared after each multiplication. The figures so contained in the product holes were thus the values of  $a_{x:\overline{1}|}$ ,  $a_{x:\overline{2}|}$ , etc. The process was thus a continued one, and a final check on its accuracy was furnished by the agreement of the final value for age x with that of  $a_x$ . As intermediate checks, values for all ages for durations of 20, 40, 60 and 80 years were computed beforehand and inserted in their appropriate places in the working sheets. These values were computed by means of the relation  $a_{x\overline{n}|} = (N_{x+1} - N_{x+n+1})/D_x$ . In these tables also the test of orderly progression of differences was applied throughout. In view of the care that has been taken in testing the various calculations and in reading and checking the proof-sheets, it is hoped that very few errors will have crept in. Information concerning any such that may be discovered will be gratefully received.

- 5. Review of Results.—(a) General.—In the present section it is proposed to briefly review the results of the investigations outlined in the preceding section. For this purpose the matter may conveniently be divided into four groups.
- (i.) A comparison of the results for the Commonwealth as a whole for the three decennia 1881-90, 1891-1900 and 1901-10.
  - (ii.) A comparison of the results obtained for the several States.
  - (iii.) A comparison of the Australian results with those for other countries.
  - (iv.) A comparison of Australian monetary values with those of standard tables.

The functions which have been selected for detailed comparison in the present review are

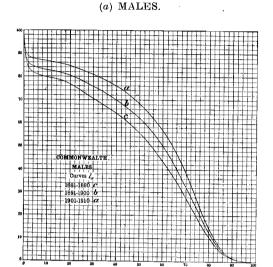
- (i.) The numbers surviving at decennial ages.
- (ii.) The probability of surviving ten years at decennial ages.
- (iii.) The expectation of life at decennial ages.
- (iv.) The age distribution of the average future lifetime for decennial age-groups.
- (v.) The "probable lifetime" or "vie probable" at decennial ages.
- (vi.) Annuity values at  $3\frac{1}{2}$  per cent. interest at decennial ages.
- (b) Commonwealth Comparisons.—Taking first the numbers surviving, the succeeding table shews for each sex separately the number who, out of 100,000 born would be surviving at each decennial age if the mortality experienced in Australia in the three decennia 1881-90, 1891-1900 and 1901-10 respectively had operated throughout the lives of those who came under observation at birth. This table furnishes at one and the same time evidence of the marked improvement in rates of mortality in successive decennia, and of the superior vitality throughout of female as compared with male life. It will be seen that whereas with the 1881-90 experience only 76.63 per cent. of the males born would reach age 20, no fewer than 84.49 per cent. would reach that age with the 1901-10 experience, an improvement of 7.86 in the percentage of survivors. Similarly in the case of females, whereas 79.10 per cent. of the females born would with the mortality of 1881-90, reach the age of 20, 86.46 would do so under the 1901-10 experience, an improvement of 7.36 in the percentage of survivors.

Commonwealth Life Tables.—Number Surviving at Decennial Ages  $(l_x)$ , 1881-1910.

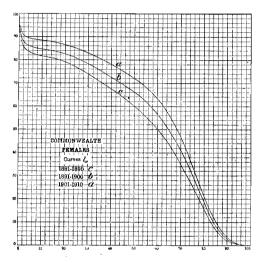
					Numbe	R SURVIVING	AT AGE SPEC	CIFIED.			
AGE.					MALES.		· · · · · ·	Females.			
				1881–90.	1891–1900.	1901–10.	1881–90.	1891–1900.	1901–10.		
0				100,000	100,000	100,000 86,622	100,000	100,000	100,000		
$\begin{array}{c} 10 \\ 20 \end{array}$	• •	• •	••	$79,700 \\ 76,630$	82,781 80,349	84,493	81,643 79,099	84,606 82,473	88,395 86,459		
30	• •	• •		70,531	75,706	80,844	73,862	78,329	82,909		
40		• •		64,106	69,788	75,887	67,453	72,487	78,001		
50				55,606	62,014	68,221	59,978	66,095	71,945		
60				43,483	50,205	56,782	50,039	56,617	63,247		
70				27,291	32,134	38,275	34,877	40,943	46,793		
80		• •		10,438	12,568	14,330	15,691	18,631	21,356		
90				1,328	1,501	1,652	2,095	2,833	3,566		
100				22	25	15	42	52	56		

Again, it may be noted that whilst 10.44 per cent. of the males born, and 15.69 per cent. of the females would reach age 80 under the mortality experience of 1881-90, no less than 14.33 per cent. of the males and 21.36 per cent. of the females born would reach that age under the experience of 1901-10.

### Number Surviving at each Age $(l_x)$ , Commonwealth, 1881-1910.



(b) FEMALES.

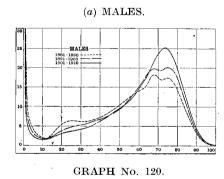


GRAPH No. 118.

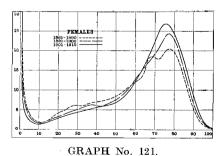
GRAPH No. 119.

In graphs Nos. 118 and 119 are furnished representations of the numbers surviving each age out of 100,000 at birth according to the Commonwealth Life Tables for each of the decennia, 1881-1890, 1891-1900, 1901-1910. Graph No. 118 relates to males, and No. 119 to females. The base of each small square represents 2 years of age, while the vertical height represents 2,000 survivors. Incidentally the area enclosed by the left hand margin, the base line and the curve c, represents the quantity of human life that would result from 100,000 births if the mortality rates for the decennium 1881-90 were in operation throughout life. Similarly the area between the same straight lines and the curve b represents the quantity of human life that would result from 100,000 births if the mortality rates for the decennium 1891-1900 had operated throughout life. Similarly also for curve a. It follows therefore, that the area between the curves a and c, represents the increase in the quantity of human life resulting from 100,000 births, which is due to the improvement in the rates of mortality between the decennium 1881-90 and the decennium 1901-1910.

## Numbers Dying $(d_x)$ Commonwealth, 1881-1910.



(b) FEMALES.



The accompanying graphs (Nos. 120 and 121) represent for each of the decennia 1881-1890, 1891-1900, and 1901-1910, the numbers alive at each age who would die before reaching the next higher age out of 100,000 at birth, if the rates of mortality experienced in the Commonwealth during the respective decennia specified, remained in force throughout life. The base of each small square represents 10 years of age, and the vertical height represents 500 deaths.

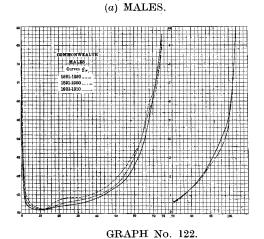
The next table, which gives another measure of the improvement in vitality, shews the probability at each decennial age of surviving 10 years.

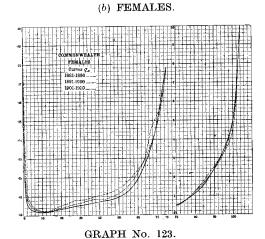
Commonwealth Life Tables.—Probability of Surviving 10 Years, 1881-1910.

			Į,	Probability of Surviving 10 Years at Age Specified.									
	Age.				Males.		Females.						
<u>-</u>			projection and an artist of the second	1881-90.	18911900.	1901–10.	1881–90.	1891–1900.	1901–10.				
0			· ·	.79700	.82781	.86622	.81643	.84606	.88395				
10				.96148	.97062	.97542	.96884	.97479	.97810				
20				.92041	.94221	.95681	.93379	.94975	.95894				
30				.90891	.92183	.93868	.91323	.92542	.94080				
<b>40</b>				.86741	.88861	.89898	.88918	.91182	.92236				
50				.78198	.80958	.83232	.83429	.85660	.87910				
60				.62762	.64006	.67407	.69700	.72316	.73985				
70				.38247	.39111	.37440	.44990	.45505	.45639				
30				.12726	.11943	.11528	.13350	.15206	.16699				
90	٠,			.01692	.01684	.00894	.02021	.01841	.01580				

It will be seen that up to age 60 the probability of surviving 10 years was for both sexes considerably higher in 1901-10, than in 1881-90, and that in the case of females this superiority was in evidence as far as 80. In the case of males at ages 70, 80, and 90, and of females at age 90 the probability of surviving 10 years was less in 1901-10 than in 1881-90. To some extent the continuous improvement of rates of mortality at younger ages through improvement in hygiene and other circumstances will tend to increase the rates of mortality at higher ages by carrying on to those ages larger numbers of persons of delicate constitutions who under the more rigorous early conditions would have died at younger ages. By such means the average health of persons of advanced age might be considerably reduced, although the number of such persons of sound health and good constitution might be on the increase.

Australian Rates of Mortality  $(q_x)$ , 1881-1910.





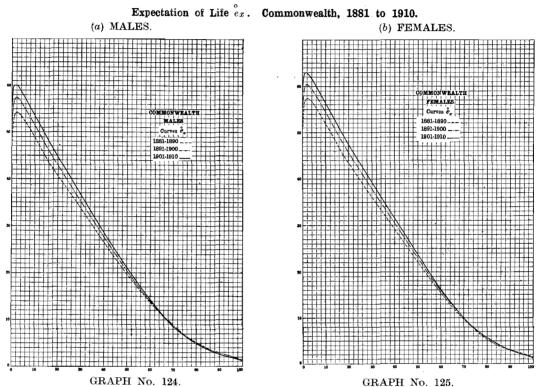
A representation of the Australian rates of mortality for each of the decennia 1881-1890, 1891-1900, and 1901-1910 is furnished in graphs Nos. 122 and 123. This rate, usually denoted by the symbol  $q_x$ , gives the probability that a person alive at any age x will die before reaching the next higher age x+1. The base of each small square represents two years of age, while the vertical height represents a rate of mortality of .002 in the case of the left hand group of curves in each graph, and .02 in the case of each right hand group.

The next table gives the expectation of life or average future lifetime of persons attaining the successive decennial ages:—

Expectation of Life.—Commonwealth Experience, 1881-1910.

					EXPECT	ATION OF LIFE	TE AT AGE SPECIFIED.					
	Age.				Males.	İ	Females.					
				1881-90.	1891–1900.	1901–10.	1881-90.	1891–1900.	1901–10.			
				Years.	Years.	Years.	Years.	Years.	Years.			
0				47.20	51.08	55.20	50.84	54.76	58.84			
10				48.86	51.43	53.53	51.95	54.46	56.39			
20				40.58	42.81	44.74	43.43	45.72	47.52			
30				33.64	35.11	36.52	36.13	37.86	39.33			
40				26.50	27.65	28.56	29.08	30.49	31.47			
50				19.74	20.45	21.16	22.06	22.93	23.69			
60			'	13.77	13.99	14.35	15.39	15.86	16.20			
70				8.82	8.90	8.67	9.70	9.89	9.96			
80				5.11	5.00	4.96	5.27	5.49	5.73			
90				2.91	2.91	2.64	2.98	3.07	2.99			
100	• •			1.32	1.29	1.18	1.37	1.23	1.24			

The figures given in this table indicate in respect of each specified age the number of years which the persons reaching that age will on the average survive. Thus, for example, according to the Commonwealth experience for 1881-90, males reaching the age of 30 would, on the average, survive 33.64 years, that is, if all the males who reached 30 could be traced to their deaths, their average age at death would be 63.64 years. The corresponding average age at death for the 1891-1900 male experience is 65.11, and for 1901-10, it is 66.52. The table thus indicates an increase of 2.88 years in the average future lifetime of males aged 30, when the experience of 1901-10 is compared with that for 1881-90. The corresponding increase in the case of females was 3.20 years. Taking the expectation of life at birth, the 1891-1900 male experience gave a result higher by 3.88 years than that for 1881-90, while the 1901-10 male experience shewed an advance of 3.92 years in 1891-1900 over 1881-90, and of 4.08 years in 1901-10 over 1891-1900. The excess of the female expectation at date of birth over the male was remarkably uniform in the three decennia, being 3.64 years in 1881-90, 3.68 years in 1891-1900, and 3.64 years in 1901-10.



The accompanying graphs (Nos. 124 and 125) furnish a representation of the expectation of life at each age for each sex according to the Commonwealth experience of the three decennia 1881-1890, 1891-1900, and 1901-1910. The base of each small square represents two years of age, while the vertical height represents an expectation of life of one year.

A point of great importance in connexion with the expectation of life is the method of its distribution over the lifetime. For example, the male expectation at birth according to the 1881-90 experience was 47.20 years. Such a result would have been obtained if everyone born had lived to the exact age of 47.20, and had then died, but it could also have arisen in an infinity of other ways, one of which was the way in which it actually did arise. It is consequently of importance to know what the exact distribution was, and for this purpose the following table has been prepared, shewing for each experience the distribution in decennial age periods:—

Average Future Duration of Life in Decennial Age Periods.—Commonwealth Experience, 1881-1910.

			AVERAGE FUTURE DURATION (AS AT AGE 0) OF LIFE, IN AGE PERIOD SPECIFIED.									
Age F	ERIOD			MALES.		FEMALES.						
	_		1881-90.	1891–1900.	1901–10.	1881-90.	1891–1900.	1901–10.				
			Years.	Years.	Years.	Years.	Years.	Years.				
0-10			8.26	8.51	8.83	8.43	8.68	9.00				
0-20			7.85	8.18	8.57	8.06	8.37	8.75				
20-30			7.36	7.82	8.28	7.67	8.06	8.48				
30-40			6.74	7.29	7.85	7.08	7.55	8.06				
l0-50			6.01	6.61	7.23	6.38	6.94	7.51				
60-60			4.99	5.66	6.29	5.53	6.18	6.80				
60-70	• •		3.58	4.16	4.83	4.32	4.93	. 5.58				
70-80			1.87	2.23	2.61	2.55	3.03	3.43				
30–90			.50	.58	.67	.76	.93	1.12				
0-105	••	• •	.04	.04	.04	.06	.09	.11				
0-105			47.20	51.08	55.20	50.84	54.76	58.84				

This table may be interpreted in the following manner. In tracing, for example, 100,000 males born at the same moment, and subject to the 1881-90 male experience throughout their lives, it would be found that the aggregate number of years lived by them during the ten years succeeding the date of their birth would be such as to give an average of 8.26 years to each of the original 100,000. Similarly the aggregate number of years lived by them during the 10 years from their 40th to their 50th birthday would be such as to give an average of 6.01 years to each of the original 100,000, and so on. Taking the important period of life from 20 to 60, it will be seen that the expectation of life according to the 1881-90 male experience was 25.10 years, that is to say, in the case of 100,000 males born at the same moment, and subject throughout life to the 1881-90 male experience the aggregate number of years lived between the 20th and 60th birthdays would be such as to give an average of 25.10 years to each of the original 100,000. The corresponding expectations for the 1891-1900 and 1901-10 experiences is 27.38 years and 29.65 years, shewing an increase of 2.28 years for 1891-1900 over 1881-90, and of 2.27 for 1901-10 over 1891-1900. Similar expectations for females are 26.66 years for 1881-90, 28.73 years for 1891-1900, and 30.85 years for 1901-10, giving an increase of 2.07 years and 2.12 years respectively.

Another measure of vitality which bears to the expectation of life a relation analogous to that which a median bears to a mean, is that which has been termed the "vie probable" or "probable lifetime." The "probable lifetime" at any given age is the number of years which must elapse before the persons who reach the given age will, by the incidence of death, be reduced to half their number. It is thus an even chance whether any one will exceed or fall short of his "vie probable."

The following table furnishes such results for decennial ages for males and females, separately in accordance with the experiences of the Commonwealth as a whole for the three decennia 1881-90, 1891-1900 and 1901-10 respectively:—

					PROBABLE LIF	ETIME AT AG	E SPECIFIED (vie probable.)				
	Age.				Males.		Females.				
				1881–90.	1891–1900.	1901–10.	1881–90.	1891–1900.	1901–10		
			-	Years.	Years.	Years.	Years.	Years.	Years.		
0				55.03	60.13	64.25	60.03	64.72	68.45		
0				52.55	55.26	57.72	56.74	59.26	61.15		
0				43.58	45.91	48.22	47.46	49.84	51.56		
0				35.52	37.11	39.06	38.89	40.93	42.30		
0				27.37	28.60	30.14	30.63	32.39	33.27		
0				19.72	20.58	21.74	22.72	23.90	24.44		
0-				13.24	13.62	14.04	15.38	15.98	16.06		
0				7.96	8.14	7.81	9.13	9.22	9.19		
0				4.21	4.10	4.13	4.42	4.62	4.92		
0				2.26	2.26	2.05	2.31	2.43	2.39		

Probable Lifetime (vie probable).—Commonwealth Experience, 1881-1910.

On comparing the figures in this table with those given above for the expectation of life, it will be seen that at the younger ages the "vie probable" is considerably higher than the expectation, that this excess diminishes with age until in the neighbourhood of 50 or 60 a point of equality is attained, after which the expectation is the higher. The integral age at which the point of equality is most nearly attained in the several experiences is as follows:—

Males, 1881-90 at age 50; 1891-1900 at age 52; 1901-10 at age 56. Females, 1881-90 at age 60; 1891-1900 at age 61; and 1901-10 at age 58.

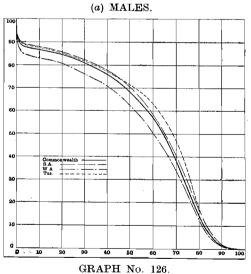
(c) Interstate Comparisons.—Complete tables for the usual elementary life table functions were computed separately for each sex in each State for each of the three decennia 1881-90 1891-1900, and 1901-10. These are given in extenso in pp. 1219 to 1278 of the Census Detailed Tables (see Volume III.). Material is thus furnished for an extensive survey of the changes in mortality conditions in each State during the thirty years under review, and also for a comparison of the results for one State with the corresponding results for others. It will not be possible, however, in the present review, to do more than touch briefly on a few of the leading features. The following table gives for the decennium 1901-10 the numbers surviving at decennial ages out of 100,000 born, according to the male and female experiences of the several States and the Commonwealth as a whole. In all the State tables the figures given for New South Wales are inclusive of those for the Federal Territory, and the figures for South Australia are inclusive of those for the Northern Territory.

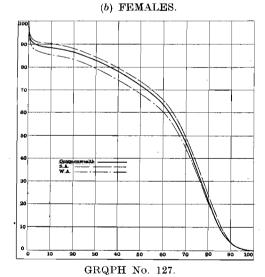
Numbers Sr	irviving at	Decennial	Ages —	-Commonwealth	and	States	1901_10

				Number Surviving at Age Specified.								
	AGE.			N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	C'wlth.		
						MALES.	<u> </u>	Sp.	<u> </u>	1		
0				100,000	100,000	100,000	100.000	100.000	100.000	100,000		
10	• •	• •	• •	86,598		100,000	100,000	100,000	100,000	100,000		
20	• •	• •	• •	84,598	86,650	87,179	87,965	82,941	87,583	86,622		
30	• •	• •	• •	81,401	84,573	84,723	85,874	80,800	85,241	84,493		
40	• •	• •	• •	76,938	81,051	80,111	82,461	76,115	81,799	80,844		
50	• •	• •	• •		76,043	74,157	77,720	70,749	77,268	75,887		
60	• •	• •	• •	69,584	68,138	65,640	70,429	62,371	71,456	68,221		
70	• •	• •	• •	58,335	56,643	53,421	58,571	50,489	63,167	56,782		
80	• •	• •	• •	39,583	38,022	35,290	40,294	33,646	46,993	38,275		
90	• •	• •	• •	15,183	13,152	14,283	16,732	12,459	17,503	14,330		
	• •	• •	• •	1,936	1,367	1,980	2,105	1,259	1,464	1,652		
100	••	• •	• •	34	17	25	30	16	11	15		
					]	FEMALES.		1				
0				100,000	100,000	100,000	100,000	100,000	100,000	100,000		
10				88,198	88,477	88,767	90,178	85,454	89,033	88,395		
20				86,409	86,423	87.054	88,127	83,376	86,511	86,459		
30				83,002	82,832	83,641	84,287	79,447	82,905	82,909		
40				78,345	77,739	78,694	79,517	74,208	78,292	78,001		
50				72,317	71,302	72,377	73,622	68,215	73,042	71,945		
60				63,738	62,473	63,388	65,209	60,044	65,522	63,247		
70				47,081	46,202	46,242	48,922	44,172	49.215	46,793		
80				21,346	20,303	22,780	23,536	21,013	24,133	21,356		
90				3,616	3,134	4,005	4,051	3,898	4,020	3,566		
00				46	42	67	103	119	55	56		

At all the important ages in both sexes the pride of place is held by South Australia and Tasmania; South Australia at the earlier ages and Tasmania at the later. With few exceptions Western Australia occupied the lowest position throughout. It will be seen that the proportion of those born who reach age 80 according to the several experiences is as follows:—Males, Tasmania, 17.50 per cent.; South Australia, 16.73 per cent.; New South Wales, 15.18 per cent.; Queensland, 14.28 per cent.; Victoria, 13.15 per cent.; and Western Australia, 12.46 per cent. Females—Tasmania, 24.13 per cent.; South Australia, 23.54 per cent.; Queensland, 22.78 per cent.; New South Wales, 21.35 per cent.; Western Australia, 21.01 per cent.; and Victoria 20.30 per cent.

Number Surviving, 1901-10  $(l_x)$ , Commonwealth and States.





The curves representing the numbers surviving at each age according to the mortality experience of the several States, cross and recross each other to such an extent that a graph containing the whole of these curves would present a somewhat confused view of the position, and would not be readily followed. It was consequently decided to shew, in graphs Nos. 126 and 127, only the maximum and minimum curves and their relation to those for the Commonwealth as a whole. The curves for the States not represented in these graphs lie in general between the inner and the outer of the curves given. In each case the base of a small square represents 10 years of age, while the height represents 10,000 survivors.

The following table furnishes particulars for each State in respect of the probability at decennial ages in each sex of surviving ten years. It will be seen from this table that the favourable positions of South Australia and Tasmania, and the unfavourable position of Western

Australia, which were commented on in connexion with the preceding table, are due in large measure to the effect of the rates experienced during the first 10 years. Thus whilst in South Australia 87.97 per cent. of the males and 90.18 per cent. of the females born reached the age of 10, the corresponding figures in the case of Western Australia were 82.94 per cent. and 85.45 per cent. For ages 10 and upwards the rates for Western Australia compare favourably with those for other States.

Probability of Surviving 10 Years at Decennial Ages.—Commonwealth and States, 1901-10.

				3	PROBABILITY	Y OF SURVIV	VING 10 YEA	ARS AT AGE	Specified.	
	Age.			N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	C'wlth
				1		MALES.	·			
0				.86598	.86650	.87179	.87965	.82941	.87583	.86622
1ŏ				.97689	.97603	.97183	.97623	.97419	.97326	.97542
20	• • •			.96221	.95836	.94556	.96026	.94202	.95962	.95681
30				.94517	.93821	.92568	.94251	.92950	.94461	.93868
<b>Ĺ</b> Õ				.90442	.89605	.88515	.90619	.88158	.92478	.89898
50				.83834	.83130	.81385	.83163	.80949	.88400	.83232
80			'	.67855	.67126	.66060	.68795	.66640	.74395	.67407
10				.38357	.34591	.40473	.41525	.37030	.37246	.37440
30				.12754	.10395	.13863	.12581	.10107	.08363	.11528
90	•••			.01754	.01243	.01243	.01428	.01259	.00748	.00894
					F	EMALES.				
0				.88198	.88477	.88767	.90178	.85454	.89033	.88395
lō				.97972	.97678	.98070	.97726	.97568	.97167	.97810
20				.96057	.95845	.96079	.95643	.95288	.95832	.95894
30				.94389	.93851	.94085	.94341	.93406	.94436	.94080
10	• • •			.92306	.91720	.91973	.92586	.91924	.93294	.92236
50				.88137	.87617	.87580	.88573	.88022	.89705	.87910
30				.73866	.73955	.72951	.75023	.73566	.75112	.73985
70				.45339	.43944	.49263	.48109	.47571	.49036	.45639
30				.16939	.15438	.17580	.17212	.18552	.16656	.16699
90				.01266	.01338	.01662	.02537	.03051	.01376	.01580

It will be seen that, with a few exceptions, the probability of surviving 10 years at the ages specified was greater for females than for males. The exceptional cases in which the probability was greater in the case of males than in that of females were at ages 20, 30 and 90 in New South Wales, at age 20 in South Australia, and at ages 10, 20 and 30 in Tasmania. In most of these cases the male excess was very small. It will also be noted that according to the experience for the Commonwealth as a whole 67.41 per cent. of the males and 73.99 per cent. of the females who reach 60 years of age live to attain their 70th birthday, while 37.44 per cent. of the males and 45.64 per cent. of the females who reach 70 years of age live to attain their 80th birthday.

The expectation of life at decennial ages in accordance with the experience of the decennium 1901-1910, is given in the following table, for each of the States and for the Commonwealth as a whole, the results for the two sexes being shewn separately.

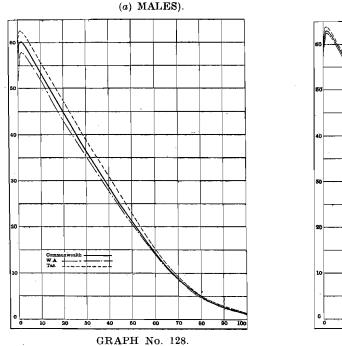
Expectation of Life.—Commonwealth and States, 1901-10.

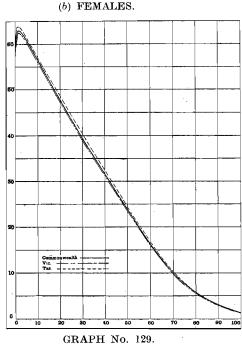
				EXPECTATION OF LIFE AT AGE SPECIFIED.									
	Age.		N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	C'wlth				
				Years.	Years.	Years.	Years.	Years.	Years.	Years.			
						MALES.							
0				55.90	55.06	54.20	56.76	51.44	57.76	55.20			
10				54.35	53.35	51.98	54.35	51.75	55.78	53.53			
20				45.50	44.52	43.32	45.53	42.97	47.16	44.74			
30				37.09	36.22	35.51	37.21	35.30	38.94	36.52			
40				28.93	28.25	27.94	29.15	27.58	30.90	28.56			
50				21.42	20.91	20.88	21.60	20.57	23.00	21.16			
60				14.50	14.07	14.45	14.89	14.16	15.29	14.35			
70				8.81	8.31	9.12	9.23	8.62	8.68	8.67			
80				5.15	4.73	5.29	5.11	4.71	4.46	4.96			
90				2.92	2.74	2.83	2.85	2.70	2.46	2.64			
100				1.31	1.26	1.20	-1.27	1.29	1.17	1.18			

				Expectation of Life at Age Specified.							
AGE.				N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	C'wlth	
				Years.	Years.	Years.	Years.	Years.	Years.	Years.	
		E.I. 20	***************************************		I	FEMALES.					
0				58.97	58.46	59.29	60.39	56.46	59.86	58.84	
10				56.69	55.90	56.62	56.83	55.82	57.07	56.39	
20				47.74	47.09	47.62	48.02	47.08	48.57	47.52	
30				39.49	38.90	39.35	39.96	39.14	40.46	39.33	
40				31.52	31.11	31.49	32.05	31.54	32.53	31.47	
50				23.71	23.45	23.79	24.20	23.86	24.51	23.69	
60				16.17	15.99	16.39	16.62	16.37	16.68	16.20	
70				9.93	9.68	10.44	10.30	10.25	10.35	9.96	
80		• •		5.73	5.59	5.86	5.79	5.94	<b>5</b> .79	5.73	
90				2.95	2.89	3.02	3.20	3.40	2.93	2.99	
L00	• •			1.15	1.20	1.27	1.39	1.39	1.20	1.24	

It will be seen that at all the more important ages the male expectation of life for individual States was above that for the Commonwealth as a whole in the cases of New South Wales, South Australia and Tasmania, and below the Commonwealth expectation in Victoria and Western Australia, while in the case of Queensland the expectation for the earlier ages was below and for the later ages above the Commonwealth results. As regards the female results the expectation for Queensland, South Australia and Tasmania was higher at practically all ages than that for the Commonwealth, while the Victorian expectation was lower throughout than the Commonwealth result. In New South Wales the expectation was higher than the Commonwealth figure at the earlier, and lower than it at the later, the reverse of this being experienced in the case of Western Australia. Throughout the States at practically all ages the expectation was markedly higher in the case of females than in that of males. The difference between male and female expectation at date of birth varied between the limits of 2.10 years in the case of Tasmania, and 5.09 years in that of Queensland. Tasmania had the highest and Western Australia the lowest male expectation at date of birth, the corresponding results for females being South Australia highest and Western Australia lowest.

## Expectation of Life, 1901-10 $(l_x)$ , Commonwealth and States.





In graph No. 128 is furnished a representation of the expectation of life of males at each age for the States of W.A. and Tas., in comparison with that for the Commonwealth, while a similar representation for females is furnished in graph No. 129 in respect of the States of Victoria and Tasmania. In each case the curves for the other four States fall in general between the inner and the outer of the curves shewn, and have been omitted to avoid confusion. The base of each small square represents 10 years of age, and the height represents an expectation of life of 5 years.

LIFE TABLES.

The following table furnishes in respect of each State the expectation of life classified according to the age period in which it was experienced. The particulars given relate to the experience for the decennium 1901-10. For a detailed account of the significance of these results see p. 331 hereinbefore.

## Average Future Duration of Life in Decennial Age Periods.—Commonwealth and States, 1901-10.

	AVERAGE FUTURE DURATION (AS AT AGE 0) OF LIFE IN AGE PERIOD SPECIFIED.									
AGE PERIOD.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	C'wlth.			
	Years.	Years.	Years.	Years.	Years.	Years.	Years.			

### MALES.

0 - 10	 		8.83	8.84	8.88	8.95	8.52	8.90	8.83
10-20	 		8.57	8.57	8.62	8.70	8.20	8.66	8.57
20-30	 		8.31	8.29	8.25	8.42	7.85	8.35	8.28
30-40	 		7.93	7.87	7.73	8.03	7.36	7.97	7.85
40-50	 		7.35	7.24	7.02	7.44	6.69	7.44	7.23
50-60	 		6.44	6.28	5.98	6.49	5.68	6.78	6.29
60-70	 		4.97	4.81	4.50	5.01	4.25	5.58	4.83
70-80	 		2.71	2.54	2.46	2.86	2.31	3.30	2.61
80-90	 		.73	.58	.70	.80	.55	.74	.67
90-105	 • •		.06	.04	.06	.06	.03	.04	.04
0-105	 		55.90	55.06	54.20	56.76	51.44	57.76	55.20

## FEMALES.

0-10				8.98	9.00	9.04	9.14	8.75	9.05	9.00
10-20				8.74	8.76	8.80	8.93	8.45	8.79	8.75
20-30				8.48	8.47	8.55	8.63	8.16	8.47	8.48
30-40				8.08	8.04	8.13	8.20	7.69	8.07	8.06
4050			)	7.54	7.47	7.56	7.67	7.13	7.57	7.51
50-60				6.84	6.73	6.83	6.98	6.45	6.98	6.80
30-70				5.63	5.52	5.56	5.80	5.30	5.83	5.58
70-80				3.45	3.34	3.49	3.68	3.28	3.70	3.43
80-90	• •			1.12	1.04	1.21	1.23	1.12	1.28	1.12
90-105		• • •		.11	.09	.12	.13	.13	.12	.11
0-105				58.97	58.46	59.29	60.39	56.46	59.86	58.84

For the period of life from the 20th to the 60th birthday, the expectation of life at date of birth in the several States was as follows:—Males: Tasmania, 30.54 years; South Australia 30.38 years; New South Wales, 30.03 years; Victoria, 29.68 years; Queensland, 28.98 years; Western Australia, 27.58 years. Females: South Australia, 31.48 years; Tasmania, 31.09 years; Queensland, 31.07 years; New South Wales, 30.94 years; Victoria, 30.71 years; Western Australia, 29.43 years. This result may be otherwise expressed by saying that according to the Tasmanian experience for 1901-10 each male born will on the average contribute to the life of the community 30.54 years between the ages of 20 and 60, and each female 31.09 years. Similarly for each of the other States.

The following table furnishes for each of the States the "vie probable" or "probable lifetime" at decennial ages in accordance with the experience of the decennium 1901-1910. For a detailed explanation of the significance of this function see p. 331. As indicated there, in connexion with the experience of the Commonwealth as a whole, the "vie probable" exceeds the expectation of life at early ages, and falls short of it at late ages, the crossing point occuring usually between 50 and 60 or thereabouts.

Probable Lifetime (vie probable).—Commonwealth and States, 1901-10.

*					PROBABL	E LIFETIME	AT AGE SPI	ECIFIED (vie	probable).	
	AGE.		,	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	C'wlth.
			·	Years	Years	Years.	Years.	Years. Years.		Years.
						MALES.				
0			•••	65.06	64.18	62.27	65.20	60.34	68.49	64.25
10		• • •	• •	58.37	57.62	55.93	58.27	55.73	61.40	57.72
20				48.82	48.11	46.56	48.77	46.34	51.87	48.22
30				39.52	38.91	37.72	39.57	37.65	42.51	39.06
40				30.46	30.00	29.15	30.65	29.09	33.30	30.14
50		• •	• •	21.93	21.62	21.16	22.26	21.25	24.25	21.74
60				14.11	13.84	14.01	14.76	14.08	15.54	14.04
70				7.89	7.45	8.29	8.53	7.88	8.03	7.81
80				4.29	3.85	4.45	4.24	3.84	3.65	4.13
90		• •	• •	2.27	2.11	2.24 .	2.23	2.06	1.88	2.05
<u> </u>				· · · · · · · · · · · · · · · · · · ·	F	EMALES.	<u> </u>	 		1
0				68.62	68.17	68.17	69.49	67.03	69.63	68.48
10			· •	61.30	60.86	60.88	61.72	60.68	62.05	61.13
$\tilde{20}$				51.68	51.28	51.28	52.16	51.16	52.57	51.50
30				42.38	42.02	42.06	42.97	42.05	43.31	42.30
40				33.30	33.00	33.18	33.94	33.21	34.23	33.2
50				24.45	24.20	24.57	25.09	24.50	25.25	24.4
60				16.04	15.81	16.45	16.68	16.23	16.69	16.0
70		• •		9.14	8.87	9.86	9.66	9.55	9.82	9.19
80				4.91	4.81	5.05	4.91	4.98	5.02	4.95
90				2.38	2.29	2.42	2.54	2.73	2.34	2.39

The difference between male and female "vie probable" at date of birth varied between the limits of 1.14 years for Tasmania, and 6.69 years for Western Australia. For both males and females Tasmania had the highest and Western Australia the lowest "vie probable."

In the following table are given particulars concerning the expectation of life at date of birth in respect of each of the States of the Commonwealth, in accordance with the experience of the three successive decennia 1881-90, 1891-1900, and 1901-10, the figures for males and females being shewn separately:—

Expectation of Life.—Commonwealth and States, 1881-1910.

	Expectation of Life at Age $0.\begin{pmatrix} 0 \\ e_0 \end{pmatrix}$										
STATES.		MALES.	1	Females.							
	1881–90.	1891–1900.	1901–10.	1881-90.	1891–1900.	1901-10.					
	Years.	Years.	Years.	Years.	Years.	Years.					
New South Wales	48.32	51.77	55.90	51.38	55.07	58.97					
Victoria	47.11	51.10	55.06	49.76	54.12	58.46					
Queensland	41.33	49.51	54.20	49.75	55.80	59.29					
South Australia	50.61	53.02	56.76	53.81	56.10	60.39					
Western Australia	46.45	43.73	51.44	51.49	49.51	56.46					
Tasmania	51.10	54.18	57.76	52.34	55.60	59.86					
Commonwealth	47.20	51.08	55.20	50.84	54.76	58.84					

In all the States the experience for 1901-10 shewed a marked improvement over that for 1891-1900, the increase being, most in evidence in the case of Western Australia. Similarly in all the States except Western Australia the experience for 1891-1900 shewed a marked improvement on that for 1881-90, the increase in this case being most in evidence in Queensland. In Western Australia, owing to the large influx of population during the decennium 1891-1900 as a result of the gold discoveries of that period, and to the unsettled conditions resultant thereon, the death rate during the decennium was high, and as a consequence the expectation of life based on the experience of the decennium was lower for both sexes than that for the previous

decennium, 1881-90. In some of the earlier investigations of Australian mortality it has been usual to comment unfavourably on the position of Queensland in this respect in relation to the other States. It will be seen from the above table, however, that although for 1881-90 Queensland occupied the lowest position of any of the States, its death rates improved so considerably during the next twenty years that in 1901-10 its male expectation exceeded that for Western Australia, and fell little short of that for Victoria, while its female expectation exceeded that for New South Wales, Victoria and Western Australia, and fell little short of that for Tasmania. Throughout the period of thirty years 1881-1910, Tasmania has had the highest male, and South Australia the highest female expectation of life at date of birth.

(d) International Comparisons.—Up to the time of writing, the published life tables which have been received in respect of the decennium 1901-10, comprise those for England and Wales, the United States of America, Sweden and Italy. Comparisons of the results furnished by these investigations with those for Australia are given in the succeeding tables, the first of which contains particulars concerning the numbers surviving at each decennial age out of 100,000 born in, and subject throughout life to the mortality rates ascertained for, the several countries specified.

Number Surviving at Decennial Ages  $(l_x)$ .—Various Countries, 1901-10.

				Ŋ	UMBER SURVIVI	NG AT AGE SPE	CIFIED.	
	Асе.			Australia.	England and Wales.	U.S.A.	Sweden.	Italy.
					MALES.		,	
					1		· · ·	
0				100,000	100,000	100,000	100,000	100,000
10				86,622	78,083	79,183	84,762	70,459
20				84,493	76,113	76,488	81,671	67,773
30	• •			80,844	72,741	71,678	76,649	63,341
40				75,887	67,668	65,465	71,925	58,904
50				68,221	59,903	57,644	65,727	53,022
60				56,782	47,564	46,640	56,568	43,935
70				38,275	29,898	30,259	41,695	28,798
80				14,330	10,608	12,263	19,357	9,539
90				1,652	1,117	1,362	2,422	632
100	• •	• •	• •	15	13	3	*	11
					FEMALES			
0				100,000	100,000	100,000	100,000	100,000
10				88,395	80,756	82,074	86,520	71,381
20				86,459	78,756	79,467	83,064	68,245
30				82,909	75,779	74,887	78,400	63,575
40				78,001	71,308	69,388	73,519	58,775
50				71,945	64,742	62,730	68,027	53,663
60				63,247	54,157	52,605	60,426	45,975
70			*	46,793	37,646	36,293	46,974	30,994
80				21,356	15,545	16,045	23,720	10,308
90				3,566	2,158	2,221	3,689	700
.00				56	43	17	*	18

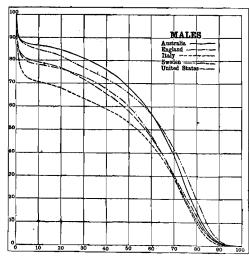
<sup>\*</sup> Not available.

It will be seen that at all the ages specified up to and including 60, the number of survivors, both male and female, was greater in Australia than in any other of the countries specified, Sweden ranking second. Beyond age 60, Sweden occupied first place, Australia ranking second. Of the other countries the figures for the United States of America did not differ markedly from those for England and Wales, while the results for Italy were practically throughout the lowest of the group. It will be seen that according to the experience for 1901-10, 84.49 per cent. of the males born in Australia reach age 20, the corresponding results for the other countries being Sweden, 81.67 per cent.; United States America, 76.49 per cent.; England and Wales, 76.11 per cent.; and Italy, 67.77 per cent. In the case of females the proportions born who would reach age 20 were as follows:—Australia, 86.46 per cent.; Sweden, 83.06 per cent.; United States of America, 79.47 per cent.; England and Wales, 78.76 per cent.; and Italy, 68.25 per cent. According to the Swedish experience 19.36 per cent. of the males, and 23.72 per cent. of the females born will reach age 80, the corresponding proportions for the other countries specified being as follows:—Australia, males 14.33 per cent., females 21.36 per cent.; United States of America, males 12.26 per cent.; females 16.05 per cent.; England and Wales, males 10.61 per cent., females, 15.55 per cent.; Italy, males 9.54 per cent., females 10.31 per cent.



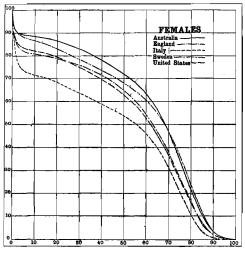
#### Number Surviving in Various Countries, 1901-10 $(l_x)$ .





GRAPH No. 130.

(b) FEMALES.

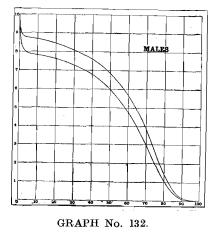


GRAPH No. 131.

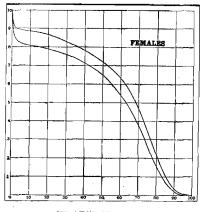
The accompanying graphs Nos. 130 and 131 furnish a representation, for each sex, of the number of survivors at each age out of 100,000 born, according to the mortality experiences of the countries specified for the 10 years, 1901-10. Incidentally they also furnish a representation of the larger quantity of human life resulting from 100,000 births in some countries than arises from the same numbers in others. This excess is represented by the area enclosed between the respective curves. The base of each small square represents 10 years of age, while the vertical height represents 10,000 survivors.

## Numbers Surviving (lx), Australia, and England, and Wales, 1901-1910.

(a) MALES.



(b) FEMALES.



GRAPH No. 133.

Graphs Nos. 132 and 133 are given for the purpose of enabling a closer comparison to be made between the experiences of Australia and of England and Wales. They are constructed for these two countries only, on similar lines to graphs 130, and 131. The base of each small square represents 10 years of age, while the vertical height represents 10,000 survivors. The upper curve in each case represents the Australian experiences, while the lower curve represents that of England and Wales. The area between the curved lines in each graph represents the greater amount of life resulting from 100,000 births, according to the Australian experience (1901-10), than would result fron the same number of births according to the experience of England and Wales for the same decennium.

The next table furnishes for the same countries the probability of surviving ten years at each decennial age, the figures, as before stated, being based on the experience of the decennium 1901-10;—

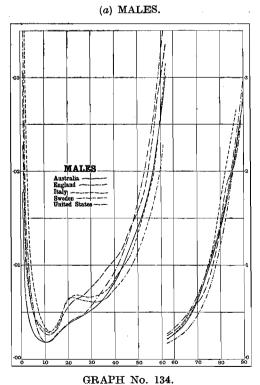
Probability of Surviving 10 Years at Decennial Ages.—Various Countries, 1901-10.

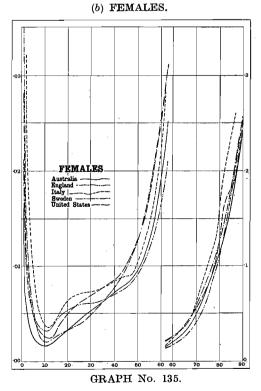
					PROBABILITY OF	Surviving 10	YEARS AT AGE S	SPECIFIED.					
`	AGE.			Australia.	England and Wales.	U.S.A.	Sweden.	Italy.					
_	MALES.												
0			)	.86622	.78083	.79183	.84762	.70459					
0				.97542	.97477	.96596	.96353	.96188					
20		• •		.95681	.95570	.93711	.93851	.93461					
30	• •			.93868	.93026	.91332	.93837	.92995					
10				.89898	.88525	.88053	.91383	.90014					
50	• •			.83232	.79402	.80910	.86065	.82862					
30	• • •			.67407	.62858	.64878	.73708	.65547					
70	• •	••		.37440	.35481	.40527	.46425	.33124					
30				.11528	.10526	.11103	.12512	.06625					
90		••	•••	.00894	.01119	.00198	*	.01741					
					FEMALES.		<u> </u>						
0				.88395	.80756	.82074	.86520	.71381					
ιŏ	• • • • • • • • • • • • • • • • • • • •	• •	- ::	.97810	.97523	.96824	.96006	.95607					
20	• • •		- ::	.95894	.96220	.94237	.94385	.93157					
30	• • •		- ::	.94080	.94100	.92657	.93774	.92450					
10			- ::	.92236	.90792	.90405	.92530	.91302					
50	• • •			.87910	.83650	.83859	.88826	.85674					
80	• • •	• • •	- ::	.73985	.69513	.68992	.77738	.67415					
70	• • •		- ::	.45639	.41293	.44210	.50496	.33258					
30		• • •	::	.16699	.13882	.13842	.15552	.06791					
90	• •	• •		.01580	.01979	.00742	*	.02571					

\* Not available.

It will be seen that with two exceptions the probability of surviving ten years was, in the case of Australia, greater for both sexes at all the decennial ages to 30 inclusive, than for any other of the countries specified, Sweden ranking second at ages 0 and 30 for males and at age 0 for females, while England and Wales ranked second at 10 and 20 for males, first at 20 and 30 for females, and second at 10 for females. For the decennial ages 40 and upwards Sweden held first place, Australia ranking second in all cases except age 80 for females, for which Australia ranked first and Sweden second.

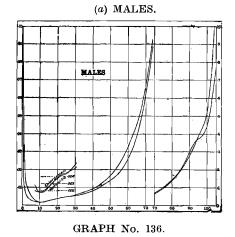
Rates of Mortality  $(q_x)$  for Various Countries, 1901-1910.

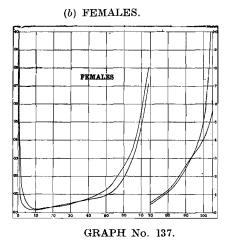




The accompanying graphs, Nos. 134 and 135, represent the rate of mortality at each age for the countries specified according to their several experiences for the decennium 1901-1910. The base of each small square represents 10 years of age, while the vertical height represents a rate of mortality of .005 in the case of the left hand group, and of .05 in the case of the right hand group in each graph.

## Rates of Mortality (qx) of Australia and of England and Wales, 1901-10.





Graphs Nos. 136 and 137 are given for the purpose of enabling a clearer comparison to be made of the rates of mortality in Australia with those in England and Wales. With the exception of a portion of the female curve between ages 20 and 35 and of both curves, above age 94 or 95 the Australian curve is the lower. The peculiar deflection in the English curves at or about age 95 would appear to be due to defective graduation. The base of each small square represents 10 years of age, and the vertical height represents a rate of .01 in the case of the left hand group in each graph, and a rate of .1 in the case of each right hand group.

In the following table are given particulars concerning the expectation of life at decennial ages according to the experience of Australia, England and Wales, the United States of America, Sweden and Italy for the decennium 1901-10:—

Expectation of Life  $(\stackrel{\circ}{e}_x)$ .—Various Countries, 1901-10.

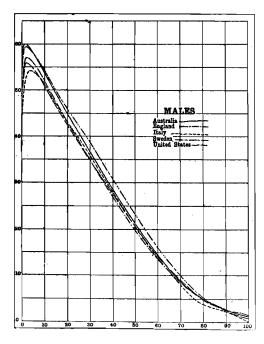
					EXPECTATION	OF LIFE AT AC	E SPECIFIED.						
	Ag	Age.		Australia.	England and Wales.	U.S.A.	Sweden.	Italy.					
				Years.	Years.	Years.	Years.	Years.					
	MALES.												
0				55.20	48.53	48.34	54.55	43.58					
10				53.53	51.81	50.66	54.05	51.25					
20				44.74	43.01	42.25	45.88	43.00					
30				36.52	34.76	34.75	38.57	35.67					
<b>4</b> 0				28.56	26.96	27.55	30.77	28.00					
50				21.16	19.76	20.59	23.17	20.50					
60				14.35	13.49	14.16	16.06	13.67					
70				8.67	8.39	8.97	9.86	8.00					
80				4.96	4.86	4.79	5.23	4.20					
90	• •			$\bf 2.64$	2.56	2.48	2.62	2.66					
00	••	••	••	1.18	1.53	.80	*	*					
				,	FEMALES	•							
0				58.84	52.38	51.92	57.00	44.42					
10				56.39	54.53	52.92	55.58	51.50					
20				47.52	45.77	44.46	47.67	43.67					
30				39.33	37.36	36.86	40.20	36.50					
40				31.47	29.37	29.38	32.54	29.00					
50	• •		• •	23.69	21.81	21.95	24.75	21.33					
60	• •			16.20	15.01	15.12	17.18	13.92					
70	• •	• •	• •	9.96	9.25	9.51	10.52	8.00					
80	• •		•• [	5.73	5.36	5.18	5.64	4.21					
90				2.99	2.94	2.82	2.88	2.80					
.00				1.24	1.80	1.10	*	*/					

<sup>\*</sup> Not available.

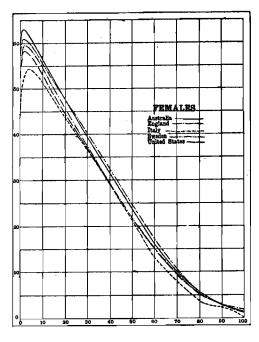
It will be seen that at age 0 for males and at ages 0 and 10 for females the Australian expectation is higher than for any other of the countries specified, the Swedish expectations ranking second. For all other decennial ages to 80 inclusive in the case of males, and to 70 inclusive in the case of females, the Swedish expectations occupy the leading position, the Australian results ranking second.

## Expectation of Life, 1901-10 $(\stackrel{\circ}{e}_x)$ .





(b) FEMALES.



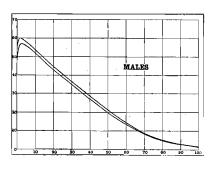
GRAPH No. 138.

GRAPH No. 139.

A representation is furnished in graphs Nos. 138 and 139 of the expectation of life at each age for the countries specified, the experience in each case being for the decennium 1901-10. The base of each small square represents 10 years of age, and the vertical height represents an expectation of life of 5 years.

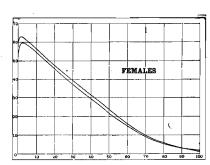
# Expectation of Life in Australia and in England and Wales, 1901-10 $(\mathring{e}_x)$ .

(a) MALES.



GRAPH No. 140.

(b) FEMALES.



GRAPH No. 141.

Graphs Nos. 140 and 141 are given for the purpose of enabling a clearer view to be obtained of the relative expectation of life in Australia and in England and Wales, according to the several experiences for the decennium 1901–1910. Except for that portion of each graph beyond age 91, the curve for Australia occupies the upper position throughout. The base of each small square represents 10 years of age, while the vertical height represents an expectation of life of 10 years.

The next table furnishes in respect of the 1901-10 mortality experience of Australia, England and Wales, the United States of America, Sweden and Italy, the distribution, according to the age at which it is experienced, of the average future duration of life as at age 0.

Average Future Duration of Life in Decennial Age Periods.—Various Countries, 1901-10.

AGE.		Australia.	England and Wales.	U.S.A.	Sweden.	Italy. Years.	
		Years.	Years.	Years.	Years.		
0–10		8.83	8.08	8.23	8.74		
10-20		8.57	7.72	7.80		7.47	
20-30	• • •	8.28	7.45	$\begin{array}{c} 7.80 \\ 7.41 \end{array}$	$8.34 \\ 7.91$	6.97	
30–40		7.85	7.04	6.87	7.43	6.55	
40–50		7.23	6.41	6.17	6.90	6.10	
50-60		6.29	5.42	5.26	6.15	5.62	
60–70		4.83	3.91	3.89	4.97	4.86	
70–80		2.61	1.99	2.13	3.10	3.70	
80–90		.67	.48	.55	.95	1.90	
90 to oldest age	••	.04	.03	.03	.06	.39 .02	
0 to oldest age		55.20	48.53	48.34	54.55	43.58	
			FEMALES.				
0-10		9.00	8.35	8.49	8.91	7.66	
		8.75	7.98	8.10	8.49	6.96	
20–30		8.48	7.74	7.73	8.08	6.60	
30–40		8.06	7.37	7.22	7.59	6.16	
0-50		7.51	6.82	6.62	7.09	5.60	
50-60		6.80	5.99	5.81	6.46	5.05	
0~70		5.58	4.65	4.50	5.44	3.92	
′0–80		3.43	2.65	2.62	3.60	2.04	
90-90		1.12	.77	.77	1.23	.41	
0 to oldest age	••	.11	.06	.06	.11	.02	
to oldest age		58.84	52.38	51.92	57.00	44.42	

It will be seen that to age 60 for males and to age 70 for females Australia occupies first place, and Sweden second place, whereas after those ages respectively Sweden occupies first, and Australia second place. In considering the effectiveness of births from the standpoint of the life of the community, the figures given by the above table furnish possibly the best measure that can be obtained. For example, taking the important age period from 20 to 60, the results indicated are that according to the Australian experience 1901-10, each male born lives on the average 29.65 years between the 20th and 60th birthdays, that is to say, while the number of years so lived is zero for those who die before 20, is 40 for those who survive 60, and is somewhere between 0 and 40 for those who die between 20 and 60, the average for all those born is 29.65. the female average for the same period in Australia was 30.85 years. The corresponding figures for the age period 20-60 in the other countries specified was as follows:—Sweden, males 28.39 years, females 29.22 years; England and Wales, males 26.32 years, females 27.92 years; the United States of America, males 25.71 years, females 27.38 years; and Italy, males 23.13 years, females 23.41 years. It will thus be seen in so far as the life of the community between ages 20 and 60 is concerned, that for 1901-10 the Australian conditions were such as to make 1000 male births in Australia equivalent to 1045 male births in Sweden, to 1126 male births in England and Wales, to 1153 male births in the United States of America, and to 1282 male births in Italy. In other words, an Australian male birth rate of 25 per 1000 of population would be equivalent from this point of view to 26.13 in Sweden, 28.15 in England and Wales, 28.83 in United States of America, and 32.05 in Italy.

The following table furnishes the "vie probable" for each of the countries specified for the decennium 1901-10:—

Probable Lifetime (vie probable).—Various Countries, 1901-10.

	AGE.			Australia.	England and Wales.	U.S.A.	Sweden.	Italy. Years.	
				Years.	Years.	Years.	Years.		
			<del>-</del>		MALES.				
	• •			64.25	58.34	57.43	65.04	53.90	
	• •	• •	• •	57.72	55.13	54.75	59.62	56.30	
	• •	• •	••	48.22	45.68	45.56	50.44	47.12	
	• •	• •	•• [	39.06	36.61	36.95	41.71	38.41	
	• •	• •	• •	30.14	27.97	28.65	32.85	29.64	
	• • .	• •	• •	$\boldsymbol{21.74}$	19.97	20.79	24.28	21.20	
	• •	• •	• •	14.04	13.02	13.88	16.27	13.50	
	• •	٠٠.	• •	7.81	7.53	8.38	9.37	7.31	
	, ••	• •	• •	4.13	4.05	3.85	4.50	3.41	
	••	• •	• •	2.05	1.92	1.97	*	1.93	

Probable Lifetime	(vie probable	).—Various Countries,	1901-10—continued.
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				Рв	OBABLE LIFETIME	AT AGE SPEC	IFIED (vie probab	; probable).					
	Ag	đ.		Australia.	England and Wales.	U.S.A.	Sweden.	Italy.					
				Years.	Years.	Years.	Years. Years.						
FEMALES.													
0	••	••		68.45	62.91	61.92	68.24	55.54					
)	• •			61.15	58.62	57.49	61.93	<b>57.4</b> 5					
)	• •			51.56	49.14	48.20	52.74	48.34					
)	• •			42.30	39.88	39.40	43.80	39.59					
)				33.27	30.94	30.81	34.88	30.80					
)				24.44	22.41	22.47	26.01	22.04					
)				16.06	14.71	14.95	17.50	13.84					
)				9.19	8.41	8.96	10.09	7.33					
)				4.92	4.53	4.15	4.87	3.43					
Ö	• •	• •	- ::	2.39	2.25	2.26	*	2.02					

<sup>\*</sup> Not available.

It will be noticed that at all the ages specified for males, and at all the ages specified except 0 and 80 for females, the Swedish "vie probable" occupied first position, Australia ranking second except in the female cases quoted, in which it ranked first. In all the countries mentioned the "vie probable" exceeded the expectation of life at the earlier ages, and fell short of it at the lower ages, the crossing point being between 60 and 70 in both sexes for Sweden, and between 50 and 60 in both sexes for the other countries.

The following table contains the expectation of life at ages 0, 20, 40, 60 and 80 for some of the leading countries of the world according to the latest available experience. It must be noted, however, that as there had been such a general world-wide improvement in mortality rates during the 30 years or more preceding the end of 1910, the latest date to which the data here given relate, a comparison of expectations for 1901-10 for one country cannot legitimately be made with those of an earlier period for another country:—

Expectation of Life.—Various Countries and Periods.

						EXPECT	ATION OF LI	FE AT AGE	
(	Counte	Y.		PERIOD.	0.	20.	40.	60.	80.
					Years.	Years.	Years.	Years.	Years
				•	MALES.	_	,		
Australia				1901-1910	55,20	44.74	28.56	14.35	4.96
Sweden		• • • • • • • • • • • • • • • • • • • •		1901-1910	54.55	45.88	30.77	16.06	5.23
Norway	• • •	• • •		1891-1900	50.41	43.58	30.62	16.39	5.64
Denmark				1895-1900	50.20	44.50	28.90	14.70	4.90
England an				1901-1910	48.53	43.01	26.96	13.49	4.86
United Stat				1901-1910	48.34	42.25	27.55	14.16	4.79
Holland				1890-1899	46.20	43.40	28.10	14.00	4.70
France		• •		1898-1903	45.74	41.53	27.15	13.81	4.8
Belgium				1891-1900	45.39	41.83	26.71	13.43	4.50
[taly				1901-1910	43.58	43.00	28.00	13.67	4.20
Finland				1891 - 1900	42.90	42.00	27.30	13.50	4.30
Germany				1891-1900	40.56	41.23	25.89	12.82	4.23
Austria	••	• •		1900-1901	37.77	40.08	25.51	12.58	4.39
				I	EMALES.	· · · · · · ·		l	
Australia				1901–1910	58.84	47.52	31.47	16.20	5.73
Sweden				1901-1910	57.00	47.67	32.54	17.18	5.64
Norway				1891-1900	54.14	46.54	32.31	17.46	6.14
Denmark				1895-1900	53.20	46.70	31.20	16.00	5. <b>3</b> (
England and				1901-1910	52.38	45.77	29.37	15.01	5.36
United Stat	es of A	1 merica		1901-1910	51.92	44.46	29. <b>3</b> 8	15.12	5.18
France				1898-1903	49.13	44.02	29.60	15.08	5.38
Iolland				1890-1899	49.00	44.80	29.70	15.00	5.00
Belgium.	• •			1891-1900	48.84	44.44	29.46	14.78	4.9
Finland		• •		1891-1900	45.60	44.20	29.50	14.60	4.90
taly	• •			1901 - 1910	44.42	43.67	29.00	13.92	4.2
Germany	• • •			1891-1900	43.97	43.37	28.14	13.60	4.48
Austria	• •			1900-1901	39.87	40.78	26.64	12.77	4.4

(e) Comparison of Annuity Values.—A comparison of the annuity values derived from the Australian mortality experience with those furnished by some of the leading British tables, which either are now or have been in the past regarded as standard, is given for males in the following table, the rate of interest in each case being  $3\frac{1}{2}$  per cent.

Comparison of Male Annuity	y Values, 3½ per cent	į.
----------------------------	-----------------------	----

				tute of Act perience, 1		British Life Tab	Offices' les, 1893.	Life	offices' Annuity es, 1893.	Annu	Government Annuitants' Experience, 1883.	
		Aus- tralian	Health F	y Males. Тм	Healthy		Whole- Life Par- ticipating					English
	Age.	Ex- perience, 1901-10. AM	Wool- house's Gradua- tion.	Text- book Gradua- tion.	Males, ex- cluding First Five Years of Assur- H <sup>M</sup> (5)	Whole- Life Par- ticipating Assur- ances. OM	Assur- ances,	At Date of Purchase.	After Five Years from Purchase. O <sup>(am)</sup>	At Date of Purchase.	After Four Years from Purchase.	Life Tables No. 3, 1837-53.
	x	 ax	ax	ax	a <sub>x</sub>	$a_x$	a <sub>x</sub>	a[x]	$a_{[x-5]+5}$	<b>a</b> [x]	a[x-4]+4	$a_x$
0 10 20 30 40 50 60 70 80 90		 21.321 22.816 21.102 19.112 16.598 13.634 10.160 6.583 3.870 1.975	21.954 20.225 18.416 16.103 13.187 9.835 6.470 3.672 1.722	19.058 21.940 20.245 18.441 16.103 13.172 9.823 6.470 3.634 1.667	21.458 19.520 18.113 15.902 13.028 9.750 6.434 3.655 1.680	22.393 20.808 18.769 16.298 13.330 9.972 6.616 3.771 1.773	21.563 20.299 18.542 16.204 13.282 9.953 6.614 3.770 1.773	20.499 18.772 16.485 13.651 10.440 7.220 4.446 2.409	18.567 16.276 13.418 10.156 6.861 4.013 1.962	18.936 17.271 15.365 13.103 10.178 7.087 4.463	18.765 17.089 15.182 12.939 10.083 6.623 3.840 1.958	16.441 21.070 19.373 17.660 15.466 12.750 9.627 6.423 3.842 2.149

It will be seen (i.) that up to age 40 the Australian Male Experience gives higher annuity values than any other of the tables quoted; (ii.) that at age 50 the Australian annuity value is practically identical with that given by the British Offices' Annuity Tables, 1893, "at date of purchase"; and (iii.) that for ages 60 and onwards there is close agreement between the Australian results and the Government Annuitants' Experience, 1883, "after four years from purchase."

A similar comparison of the female annuity values derived from the Australian Mortality Experience, 1901-10, with the corresponding female values from some of the leading British standard tables is furnished in the next table. As in the case of male lives, the rate of interest involved is  $3\frac{1}{2}$  per cent. in each case.

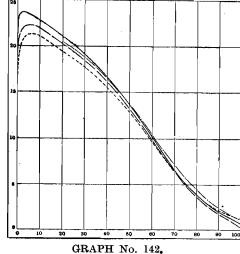
Comparison of Female Annuity Values, 31 per cent.

Age.		Australian	Institute of Actuaries' Experience, 1869.	British O Annuity T	ffices' Life ables, 1893.	Government Experience	Englis <b>h</b> Life	
		Experience. 1901-10. AF	Healthy Females. H <sup>F</sup>	At Date of Purchase. O(af)	After Five Years from Purchase. O(af)	At Date of Purchase.	After Four Years from Purchase.	Tables, No. 3, 1837-53.
		$a_x$	$a_x$	a[x]	$a_{[x-5]+5}$	$a_{[x]}$	$a_{[x-4]+4}$	a <sub>x</sub>
0	]	22.019						17.063
.0	]	23.248	21.154	[				21.085
0		21.654	19.558	20.718		20.409	20.242	19.482
0	• •	19.863	18.092	19.090	18.881	18.898	18.715	17.927
0	• • •	17.682	16.323	17.040	16.788	16.980	16.787	15.961
0 0	• •	14.823	13.812	14.647	14.349	14.434	14.230	13.361
0	• •	11.207	10.435	11.691	11.378	11.287	.11.045	10.102
0	• •	7.454	6.852	8.137	7.785	7.754	7.420	6.809
0	• •	4.469	4.247	4.945	4.512	4.834	4.227	4.101
U	• •	2.274	2.502	2.662	2.204		2.029	2,925

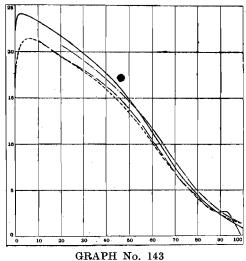
It will be seen from the foregoing table (i.) that up to age 50 the Australian Female Experience gives higher annuity values than any other of the tables quoted; (ii.) that at age 60 the Australian Experience gives a value which approximates to that of the Government Annuitants Experience "at date of purchase"; (iii.) that at age 70 the Australian Experience gives a value which approximates to that furnished by the Government Annuitants' Experience "after four years from purchase"; (iv.) that at ages 80 and 90 the Australian values do not differ greatly from those furnished by the British Offices' Life Annuity Tables "after five years from purchase."

Annuity Values (ax) at  $3\frac{1}{2}$  per cent.





(a) MALES.



(b) FEMALES.

The accompanying graphs, Nos. 142 and 143, furnish a representation of the annuity values at each age by the Australian Life Tables, and some of the leading British Tables at 3½ per cent.

In graph No. 142 the values by the several tables are shewn as follows:

Australian Male Experience, A<sup>M</sup>
Institute of Actuaries H<sup>M</sup> Table

English Life Table No. 3

In graph No. 143 the values by the several tables are shewn as follows:—

Australian Female Experience AF

Institute of Actuaries H<sup>F</sup> Table — \_ \_ \_ \_ \_

English Life Table, No. 3 -----British Offices O<sup>(af)</sup> (at date of purchase) · \_\_\_\_ · \_\_\_ · \_\_\_ · \_\_\_

The fluctuation in the H<sup>F</sup> curve after age 87 is an indication of defective graduation of the data.

## NOTE A (see page 312).

# Estimate of Number of Years of Life Experienced by Persons of a Given Age in a Given Period.

Assuming that the total numbers of each sex have been determined in a population at the end of each of the years 0 to n inclusive, and that the distribution in age-groups has been ascertained by a Census at the points of time denoted by  $\frac{1}{4}$  and  $n+\frac{1}{4}$ , it is required to determine the number of years of life of each sex experienced in the community in each of the age-groups during the period of n years from 1 to n inclusive.

In the succeeding investigation it will be assumed that each sex is separately dealt with, and all expressions will relate to one sex only.

Let  $m\bar{s}|L_t$  denote the number of persons at the end of the year t in the age-group commencing with exact age m and ending with exact age m+s, that is, having age last birthday m to m+s-1, and let  $P_t$  denote the total population of the sex under consideration at all ages at the end of year t.

Then  $m\bar{s}|L_t/P_t$  denotes the proportion of this population, in the age-group  $m\bar{s}|$  at the point of time t.

If it be assumed that this proportion is a function of t = f(t) say, the number of years of life may readily be determined by integration.

Thus, since  $_{m\bar{s}}|\mathrm{L}_{t}$  /  $\mathrm{P}_{t}=f$  (t); therefore  $_{m\bar{s}}|\mathrm{L}_{t}=\mathrm{P}_{t}f(t)$ .

The number of years of life experienced in the age-group  $m\overline{s}$  during the period 0 to n is evidently the integral  $\int_0^n m\overline{s} |\mathcal{L}_t dt| = \int_0^n \mathcal{P}_t f(t) dt$ .

If it be assumed that f(t) is a function of t of the first degree = a + bt, the values of a and b may readily be determined from the Census results.

Thus, 
$$a + \frac{1}{4}b = \frac{1}{m^{3}}L_{\frac{1}{4}}/P_{\frac{1}{4}} = r_{\frac{1}{4}}$$
, say  $a + (n + \frac{1}{4})b = \frac{1}{m^{3}}L_{n+\frac{1}{4}}/P_{n+\frac{1}{4}} = r_{n+\frac{1}{4}}$ , say  $\therefore nb = r_{n+\frac{1}{4}} - r_{\frac{1}{4}}$ , and  $b = \frac{1}{n}(r_{n+\frac{1}{4}} - r_{\frac{1}{4}})$ 

Hence  $a = r_{\frac{1}{4}} - \frac{1}{4n}(r_{n+\frac{1}{4}} - r_{\frac{1}{4}})$  and  $f(t) = a + bt = \{r_{\frac{1}{4}} - \frac{1}{4n}(r_{n+\frac{1}{4}} - r_{\frac{1}{4}})\} + \frac{t}{n}(r_{n+\frac{1}{4}} - r_{\frac{1}{4}})$ 

$$\therefore \int_{0}^{n} P_{t} f(t) dt = \int_{0}^{n} P_{t} (a + bt) dt = a \int_{0}^{n} P_{t} dt + b \int_{0}^{n} t P_{t} dt$$

$$= \{r_{\frac{1}{4}} - \frac{1}{4n}(r_{n+\frac{1}{4}} - r_{\frac{1}{4}})\} \int_{0}^{n} P_{t} dt + \frac{1}{n}(r_{n+\frac{1}{4}} - r_{\frac{1}{4}}) \int_{0}^{n} t P_{t} dt$$

The values of r will, of course, vary with each age-group, but the integrals  $\int_0^n P_t dt$  and  $\int_0^n t P_t dt$  will remain constant for all age-groups for the period of n years.

From the populations given at the end of the years 0 to n, the values of these integrals can readily be determined by applying an appropriate formula for approximate summation, such, for example, as  $\frac{1}{3}$  (1, 4, 2, 4, 2 . . . . 2, 4, 1).

If populations are available for the ends of successive quarters the corresponding formula will be  $\frac{1}{12}$  (1, 4, 2, 4, 2 . . . . 2, 4, 1).

The assumption that f(t) = a + b t, is equivalent to assuming that where the *proportion* of total population which is represented by the number in a given age-group changes from one census to another, this change of *proportion* has taken place by equal increments or decrements for equal durations.

This assumption, while not strictly accurate, is probably in most cases in reasonably close accord with the facts. It has, in addition, the advantage in practice that if, on this assumption the formula  $m_{\overline{s}}|L_t=P_tf(t)$  be applied to determine the number of persons in the age-group  $m_{\overline{s}}|$  for the point of time t, the sum of such determinations for all the age-groups comprised in the population will give a total of  $P_t$ .

This is evident since 
$$\Sigma_{m\bar{s}}|_{L_t} = \Sigma P_t f(t) = P_t \Sigma \left[ \left\{ r_{\frac{1}{2}} - \frac{1}{4n} (r_{n+\frac{1}{2}} - r_{\frac{1}{2}}) \right\} + \frac{t}{n} (r_{n+\frac{1}{2}} - r_{\frac{1}{2}}) \right]$$
  
=  $P_t$ , since  $\Sigma r_{\frac{1}{2}} = \Sigma r_{n+\frac{1}{2}} = 1$ .

#### NOTE B (see page 321).

## Definite integrals of a third degree function in terms of equidistant ordinates.

Given four equidistant values of  $f(x) = a + bx + cx^2 + dx^3$ , viz., f(x), f(x+1), f(x+2), and f(x+3), to find in terms of these four ordinates the integrals for the three successive intervals.

Since 
$$\int_{x}^{x+3} f(x) dx = \frac{3}{8} \left\{ (f(x) + 3f(x+1) + 3f(x+2) + f(x+3)) \right\}$$
  
and  $\int_{x+1}^{x+3} (x) dx = \frac{1}{3} \left\{ f(x+1) + 4f(x+2) + f(x+3) \right\}$   
and since  $\int_{x}^{x+1} f(x) dx = \int_{x}^{x+3} f(x) dx - \int_{x+1}^{x+3} f(x) dx$   
 $\therefore \int_{x}^{x+1} f(x) dx = \frac{3}{8} f(x) + \frac{19}{24} f(x+1) - \frac{5}{24} f(x+2) + \frac{1}{24} f(x+3)$   
 $= \frac{1}{24} \left\{ 9f(x) + 19f(x+1) - 5f(x+2) + f(x+3) \right\}$   
Similarly  $\int_{x+2}^{x+3} (x) dx = \frac{1}{24} \left\{ f(x) - 5f(x+1) + 19f(x+2) + 9f(x+3) \right\}$   
But since  $\int_{x}^{x+3} f(x) dx = \left\{ \int_{x}^{x+1} + \int_{x+1}^{x+2} + \int_{x+2}^{x+3} f(x) dx \right\}$   
 $\therefore \int_{x+1}^{x+2} (x) dx = \left\{ \int_{x}^{x+3} - \int_{x}^{x+1} - \int_{x+2}^{x+3} f(x) dx \right\}$   
 $= \frac{1}{24} \left\{ -f(x) + 13f(x+1) + 13f(x+2) - f(x+3) \right\}$   
 $= \frac{1}{24} \left[ 13 \left\{ f(x+1) + f(x+2) \right\} - \left\{ f(x) + f(x+3) \right\} \right]$ 

It thus appears that if four equidistant ordinates to a third degree curve are given, the integral for the central interval may be obtained by subtracting the sum of the two exterior ordinates from thirteen times the sum of the two mean ordinates, and dividing the difference by twenty-four.

## CHAPTER XXI.

## OCCUPATIONS.

- 1. General.—The field of investigation comprised under the head of "occupations" is one of the most complex of those that come within the ambit of the Census. To the difficulties of classification, which are in themselves numerous and weighty, is added the fact that when the data have been duly classified, the detailed items are so numerous and for purposes of adequate analysis require to be so segregated in respect of sex, age, grade of employment, geographical distribution and epoch, that the mere publication of the results becomes a serious undertaking. This necessary expansiveness renders it a matter of some difficulty to present in review a series of clearly outlined sketches of the leading features of the data, and the indications which they furnish of the trend and development of the population in respect of occupation, since such sketches require a condensation of the material which may, if not appropriately carried out, result in the presentation of aggregates which have little significance. The detailed tabulation of the data is comprised in pp. 1279 to 1848 of Volume III. of the Census Detailed Tables, and although it is necessarily not exhaustive, it is believed that all the more important phases of the question have been there analysed. The principal heads of division selected were eight in number, viz., (i.) Nature of occupation; (ii.) Grade of occupation; (iii.) Sex; (iv.) Age; (v.) Conjugal Condition of Females; (vi.) Geographical distribution; (vii.) Epoch; (viii.) Duration of unemployment. These heads have been extensively subdivided, and cross tabulations have been carried out as fully as the importance of the various matters appeared to warrant. and 19, covering pp. 1326 to 1527 inclusive, contain the most detailed analysis of the results, and furnish for the Commonwealth as a whole particulars in respect of each sex for 8 classes, 27 orders, 111 sub-orders, and 654 groups of occupations, classified according to 6 grades of occupations and 22 groups of ages. These tables furnish the most complete presentation of occupation data that has ever been attempted in Australia. The very completeness of this presentation necessarily renders these tables unsuitable for the purpose of a comprehensive view of the various aspects such as is proposed in the present chapter, and consequently numerous summaries have been prepared which are presented in the following pages.
- 2. Form of Inquiry.—The form in which the inquiry in respect of occupation was made on the Personal Card was as follows:—

  - (b) If out of work, state period.....
  - (c) Occupation of Employer (if any).....

In addition, an extensive series of notes was furnished on the instructions, which accompanied the Householders' Schedules. These notes were as follows:—

Instructions for filling in Personal Cards:—

Line 14.—

Army and Navy.—If on actual service, state so. If retired, state present occupation.

Persons in the service of the Federal, State, or Local Governments are to state occupation, position, department, adding F if in Federal, S if in State, and L if in Local Government service; and if engaged in any other occupation, to specify its nature.

Justices of the Peace, Aldermen, Town Councillors, &c., and other important public officers are to state their ordinary profession or occupation.

Ministers of Religion are to state denomination. The indefinite term "Clerk" must not be used. Local or occasional preachers are to return their ordinary occupation.

Members of the Legal Profession are to state whether in actual practice; if not practising, to state present occupation. Persons employed in solicitors' offices are to state whether they are articled or other clerks.

Members of the Medical Profession are to state whether they are physicians, surgeons, or general practitioners, and to return themselves as practising or not practising; if not practising, to state present occupation.

Teachers, Authors, Public Writers, and Artists are to state the particular branch of science, literature, or art in which they are engaged.

Engineers are to state whether civil, mechanical, electrical, mining, marine, &c.; also the nature of work on which engaged.

Surveyors are to state whether land, mining, marine, &c.

Engine-drivers, Stokers, Firemen, &c., are to state the nature of the business in connexion with which they are occupied, thus:—" Engine-driver at Sawmill," "Stoker at Foundry." "Fireman on Railway," &c. Engine-drivers are not to be entered as engineers.

Miners are to specify the nature of the mineral on which they work, and in respect of metallic ores, to state whether lode or alluvial. A miner working for another is to return himself as "miner," and not as "labourer."

Artisans and Mechanics are to state the particular branch of their trade, thus—"Ship's carpenter," "House carpenter," "Coachsmith," "Locksmith," "Horseshoer," &c.

Carters, Carriers, Labourers, Servants, &c., are to be described in connexion with their usual employment, thus—"Carter to grocer," "Bullock-driver on station," "Labourer making roads," "Omnibus-driver," "Cabman," "Railway porter," "Telegraph messenger," "Domestic servant."

Persons engaged in Trade or Commerce, as Merchants, Manufacturers, Storekeepers, Retailers, Brokers, Agents, Auctioneers, &c., are to state the particular business in which they are engaged, or the principal commodity in which they deal, thus—" Grain merchant," "Hat manufacturer."

Clerks, Bookkeepers, Salesmen, Saleswomen, Shopmen, Commercial Travellers, &c., are to be described according to the business with which they are connected, thus—"Bank clerk," "Railway clerk," "Salesman in soft-goods warehouse," "Shopman to grocer," "Commercial traveller to wine merchant," &c.

Farmer or Market Gardener.—These terms are to be applied to all persons actually in occupation of land and tilling, whether proprietors or tenants; the term "landowner" is too vague. Market gardeners must not omit the word "Market." The term "Farmer" is understood to mean "Agricultural farmer"; if "Dairy" or "Poultry farmer," &c., it should be so stated.

Persons not following any Profession, Trade, or Calling, and not holding any public office, but possessed of independent means, are to designate themselves as "Proprietor of land," "Proprietor of houses," "Capitalist," "Annuitant," as the case may be. The term "Householder" is not to be used in place of "Proprietor of houses," nor the words "Gentleman" or "Lady" in place of "No occupation."

Wives, Sons, Daughters, Brothers, and other Relatives habitually helping on farms and stations, or engaged in hotels, shops, or other industrial pursuits, are to be returned as "Wife assisting," "Son assisting," &c., as the case may be.

Women.—The occupations of women who are engaged in any other than domestic duties are to be distinctly recorded, but women are not to be entered as engaged in the occupations of their husbands, fathers, &c., unless they habitually assist them. When only in the capacity of wife, mother, daughter, sister, &c., write, "Domestic duties."

Children being educated are to be designated "Scholar," if not engaged as well in any industrial pursuit; but if following any such pursuit during portion of their time, as, for instance, delivering or selling newspapers, minding cows, &c., before or after school hours, are to be set down as following that pursuit, the entry on line 13 (a) sufficiently showing that they are also receiving education.

Persons in Hospitals, Asylums, Gaols, &c.—The position of officers in the Institution, as "Warder," "Nurse," &c., is to be given, and in the case of inmates, "Prisoner," "Patient," &c.; their calling (if any) before they entered the institution is to be inserted on line 14.

N.B.—Great care is to be taken in writing the name of an occupation which is common to many kinds or branches of business, to add the name of the employer's trade or business. The following occupations are of this type, and require the additional information suggested within parentheses, thus—Assistant (to draper), Accountant (to ironmonger), Apprentice (to baker), Agent (for shipping company), Cashier (in bank), Clerk (to brewer), Carter (to miller), Engine-driver (on railway), Labourer (on wharf, on roads, &c.), &c., &c. Persons engaged in more than one occupation are requested to state their several occupations, and to underline the principal one.

Line 14 (a) and (b).—Write E if an employer of labour other than household servants; O if in business on own account but not employing others for salary or wages; A if assisting head of household in his business but not receiving salary or wages; W if earning salary or wages; and (except in cases of leave of absence) add N if out of work for more than a week prior to Census, stating under (b) period during which out of work.

Line 14 (c).—If earning salary or wages, state occupation of employer.

In the actual form of inquiry two additions were made to that used in Australia on previous occasions, one being a request for a specification of the period of unemployment of persons who had been out of work for more than a week prior to the Census, the other a request that persons who were in employment should state the occupation of their employers. The object of this latter inquiry was that of effecting an improvement on the degree of definiteness with which many of the occupations had been stated on previous occasions.

Classification.—Before proceeding to a consideration of the results obtained at the Census, a brief outline of the scheme of classification of occupations adopted for the tabulation of the data may be of service. This scheme is, with minor modifications, that which was used at the Australian Censuses of 1891 and 1901, and differs in some important respects from the scheme of classification adopted in connection with the Census of England and Wales, and also from the scheme of nomenclature recommended by the International Institute of Statistics at its Chicago session in 1893. In view of the progress which has been made in the last 20 years in securing the adoption of an international system of nomenclature for diseases and for causes of death, it is perhaps not too much to hope that a system of nomenclature of occupations will eventually be devised which will meet the requirements of different communities so well that its international adoption will be secured. The task, however, is a difficult one, since in addition to the objection which universally attaches to any such change, viz., the break in continuity of record, and the consequent want of comparability of data for the country making the change, there is the further difficulty that a classification which is eminently suitable for a country in an advanced stage of industrial development may be totally unsuited to the needs of a country whose principal occupations are those associated with the production of raw materials. tensive detail may thus be requisite in some groups in one class of community, and in quite different ones in other classes, while there is the possibility that an elaboration sufficiently extensive to meet the requirements of all would prove too great for inclusion within the limits of a workable scheme. Notwithstanding the admitted difficulties of the situation it appears desirable that further efforts should be made towards the adoption of a suitable international scheme, and it is proposed before the occasion of the next Census to make an exhaustive investigation of the various schemes of classification in force, with a view to ascertaining the lines on which modifications might be made so as to meet the requirements of all.

The main features of the Australian scheme of classification are indicated in the following statement, which furnishes a definition of the principal classes:—

## CLASSIFICATION OF OCCUPATIONS.

#### DEFINITION OF PRINCIPAL CLASSES.

#### Section A.—Breadwinners.

- Class I. Professional.—Embracing all persons, not otherwise classed, mainly engaged in the government and defence of the country, and in satisfying the moral, intellectual and social wants of its inhabitants.
- Class II. Domestic.—Embracing all persons engaged in the supply of board and lodging, and in rendering personal services for which remuneration is usually paid.
- Class III. Commercial.—Embracing all persons directly connected with the hire, sale, transfer, distribution, storage, and security of property and materials.
- Class IV. Transport and Communication.—Embracing all persons engaged in the transport of persons or goods, or in effecting communication.
- Class V. Industrial.—Embracing all persons, not otherwise classed, who are principally engaged in various works of utility, or in specialities connected with the manufacture, construction, modification or alteration of materials so as to render them more available for the various uses of man, but excluding, as far as possible, all who are mainly or solely engaged in the service of commercial interchange.
- Class VI. Primary Producers.—Embracing all persons mainly engaged in the cultivation or acquisition of food products, and in obtaining other raw materials from natural sources.
  - Class VII. Independent.—Embracing all persons of independent means having no specific occupation.

### Section B .- Dependents : Non-breadwinners.

Class VIII. Dependents.—Embracing all persons dependent upon relatives or natural guardians, including wives, children, and others not otherwise engaged in pursuits for which remuneration is paid; and all persons depending upon private charity, or whose support is a burthen on the public revenue.

One of the outstanding differences between the Australian and the English schemes of classification is that whilst the Australian scheme provides for a separation, as far as practicable, of the "commercial" from the "industrial" occupations, the English scheme makes no such provision in its main division, although an analysis of the published detailed results would enable such a separation to be made approximately.

- 4. Data Unspecified.—As was the case with all other subjects of inquiry, a proportion of the people enumerated failed to furnish the desired information in connection with occupations. Amongst the male population there were 7,043 who failed to indicate either the nature or the grade of their occupation, 30,632 who indicated the nature of their occupation but failed to indicate the grade, and 32,343, who indicated the grade of their occupation but failed to indicate its nature; in all a total of 70,018 males whose specification of occupation was more or less defective. In the case of females there were 823 who furnished no indication as to nature or grade of occupation, 4,313 who indicated nature but not grade, and 3,215 who indicated grade but not nature of occupation, a total of 8,351 females whose specification of employment was incomplete. There were thus about 3 per cent. of the males, and about 4 per thousand of the females whose information in respect of occupations was defective. In the preparation of the material for the purposes of the present chapter these unspecified data have been distributed amongst the various categories in proportion to those specified, care being taken to duly allow as fully as practicable for the specified details in making the allocation of the unspecified items.
- 5. Breadwinners and Dependents.—After allowing for unspecified data the total number of "breadwinners" disclosed by the Census results was 2,004,130, of whom 1,605,478 were males, and 398,652 were females. The remainder of the population, totalling 2,450,875, and comprising 707,557 males and 1,743,318 females, were classed as "dependents." Under this latter general heading have been grouped the following sections of the population:—(i.) Wives, mothers, and others performing domestic duties for which remuneration is not paid; (ii.) Dependent scholars and students; (iii.) Dependent relatives and others not stated to be performing domestic duties; (iv.) Inmates of charitable institutions; (v.) Inmates of penal establishments. These terms, viz., "breadwinners" and "dependent" require to be used with care as certain of those classed as "dependents" contribute much more largely to the upkeep of the community than certain others who are classed as "breadwinners." For example, all married women engaged in domestic duties for which direct payment is not made, are classed as "dependents," while all pensioners are classed as "breadwinners." There can be no question that as regards the current life of the community the former group contribute the more largely.

The numbers of breadwinners and dependents of each sex and of the two sexes combined in each State and Territory at the date of the Census are shewn in the following table :—

Number	٥f	Breadwinners	and	Danundante	1011
Mumbers	UΙ	Dreauwilliers	аци	ревеплентя.	TOTT.

States		MALES.			FEMALES	S.	PERSONS.			
and Territories	Bread- winners.	Dependents.	Total.	Bread- winners.	Dependents.	Total.	Bread- winners.	Dependents.	Total.	
States—			•				-			
N.S.W.	591,756	265,942	857,698	138,536	650,500	789,036	730,292	916,442	1,646,734	
Vic	452,895		655,591	141,161	518,799	659,960	594,056	721,495		
Qld	231,102	98,404	329,506	48,585	227,722	276,307	279,687	326,126	605,813	
S.A	144,992	62,366	207,358	34,745	166,455	201,200	179,737	228,821	408,558	
W.A	117,580	43,985	161,565	20,976	99,573	120,549	138,556	143,558		
Tas	63,941	33,650	97,591	14,436	79,184	93,620	78,377	112,834	191,211	
Territories			I						ı	
Northern	2,498	236	2,734	103	473	576	2,601	709		
Federal	714	278	992	110	612	722	824	890	1,714	
C'wealth	1,605,478	707,557	2,313,035	398,652	1,743,318	2,141,970	2,004,130	2,450,875	4,455,005	

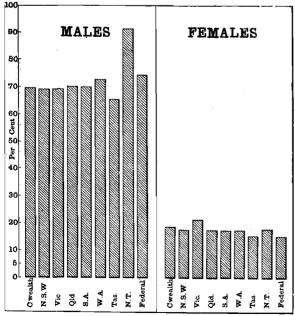
The succeeding table furnishes in each case the proportions per cent of the total male, female or combined population, who were breadwinners or dependents respectively:—

Distribution per cent. of Breadwinners and Dependents, 1911.

States		MALES.			FEMALES	•	PERSONS.			
and Territories	Bread- winners.	Dependents.	Total.	Bread- winners.	Depend- ents.	Total.	Bread- winners.	Dependents.	Total.	
Otat										
States— N.S.W.	68.99	31.01	100.00	17.56	82.44	100.00	44.35	55,65	100.00	
Vic.	69.08	30.92	100.00	21.39	78.61	100.00	45.16	54.84	100.00	
Qld	70.14	29.86	100.00	17.58	82.42	100.00	46.17	53.83	100.00	
S.A	69.92	30.08	100.00	17.27	82.73	100.00	43.99	56.01	100.00	
W.A	72.78	27.22	100.00	17.40	82.60	100.00	49.11	50.89	100.00	
Tas	65.52	34.48	100.00	15.42	84.58	100.00	40.99	59.01	100.00	
Territories			-							
Northern	91.37	8.63	100.00	17.88	82.12	100.00	78.58	21.42	100.00	
Federal	71.97	28.03	100.00	15.23	84.77	100.00	48.07	51.93	100.00	
C'wealth	69.41	30.59	100.00	18.61	81.39	100.00	44.99	55.01	100.00	

It will be seen that amongst the States, Western Australia had an exceptionally high, and Tasmania an exceptionally low proportion of male breadwinners, while the proportions for the

Breadwinners.—Proportion per cent. of Population, 1911.



GRAPH No. 144.

other four States differed little from each other. In the case of females, Victoria had an exceptionally high, and Tasmania an exceptionally low percentage of breadwinners, the proportions for the other four States being approximately equal to one another.

The accompanying Graph (No. 144) furnishes for the Commonwealth as a whole as well as for each of the component States and Territories, a representation of the proportion per cent. which the breadwinners of each sex were of the total population of that sex. The scale on the left of the Graph shewing percentages relates to both  $\bar{\text{t}}$ he male and the female portions. This Graph illustrates the approximate equality of percentages for males in New South Wales, Victoria, Queensland and South Australia, and for females in New South Wales, Queensland, South Australia and Western Australia. It will be seen that apart from the Northern Territory males, the deviations for either sex from the Commonwealth percentage for that sex were small.

6. Classes of Occupation.—The following table furnishes, for the male population of the several States and Territories, a distribution into the eight Classes defined in Section 3 above (p. 349). The results shewn are both the actual numbers and also the proportion per cent. of the total male population in each case.

Classes of Occupation, Males. Commonwealth, States and Territories, 1911.

	STATES.							TERRITORIES.	
Class.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	North- ern.	Federal	C'wlth

#### NUMBER.

	1 .								
I. Professional	 37,275	27,305	11,551	6,804	6,815	3,449	73	52	93,324
II. Domestic	 19,075	13,877	6,416	3,477	4.362	1,526	127	11	48,871
III. Commercial	 89,394	76,203	29,268	22,790	15,522	7,220	196	19	240,612
IV. Transport and	'-, -	. ,	٠, ٠,	, -	,	· 1			
Communication	 60.796	38,206	22,649	15,722	11,952	4,477	194	13	154,009
V. Industrial	 173,725	143,915	57.453	45,064	24,288	15,005	208	213	459,871
VI. Primary Producers	 204,708	147,635	101,335	49,958	54,062	31,715	1,691	401	591,505
VII. Independent	 6,783	5.754	2,430	1,177	579	549	9	5	17,286
VIII. Dependents	 265,942	202,696	98,404	62,366	43,985	33,650	236	278	707,557
TOTAL, MALES	 857,698	655,591	329,506	207,358	161,565	97,591	2,734	992	2313035
	Į								1

#### PERCENTAGE ON TOTAL MALES.

L									
II Demostic	. 4.35 2.22	$\begin{array}{ c c c } \hline 4.16 \\ 2.12 \\ \hline \end{array}$	3.51 1.95	3.28 1.68	$\frac{4.22}{2.70}$	3.53 1.56	2.67 4.64	$5.24 \\ 1.11$	4.04 2.11
III Commondal	10.42	11.62	8.88	10.99	9.61	7.40	7.17	1.92	10.40
IV. Transport and Communication .	7.09	5.83	6.87	7.58	7.40	4.59	7.10	1.31	6.66
V Industrial	20.25		17.44	21.73	15.03	15.38	7.61	21.47	19.88
	. 23.87	22.52	30.75	24.09	33.46	32.50	61.85	40.42	25.57 .75
VOTT D	$\frac{.79}{31.01}$	$\frac{.88}{30.92}$	$\begin{array}{ c c c c } .74 \\ 29.86 \end{array}$	30.08	$\begin{array}{c c} .36 \\ 27.22 \end{array}$	.56 34.48	.33 8.63	28.03	30.59
			100.00	100.00	100.00	100.00	100.00	100.00	100.00
TOTAL, MALES .	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
					_				

In general the States having the larger total populations had also the larger numbers of males in the several occupation classes, the principal exception being in the case of Western Australia, where the numbers in the Professional, Domestic, and Primary Producing Classes were respectively greater than the corresponding numbers for South Australia.

Amongst the States the Professional Class was proportionately most largely represented amongst males in New South Wales (4.35 per cent.), and least largely in South Australia (3.28 per cent.), the Domestic Class most largely in Western Australia (2.70 per cent.), and least largely in Tasmania (1.56 per cent.); the Commercial Class most largely in Victoria (11.62 per cent.), and least largely in Tasmania (7.40 per cent.); the Transport and Communication Class most largely in South Australia (7.58 per cent.), and least largely in Tasmania (4.59 per cent.); the Industrial Class most largely in Victoria (21.95 per cent.), and least largely in Western Australia (15.03 per cent.); the Primary Producers most largely in Western Australia (33.46 per cent.), and least largely in Victoria (22.52 per cent.); the Independent Class most largely in Victoria (0.88 per cent.), and least largely in Western Australia (0.36 per cent.); the Dependent Class most largely in Tasmania (34.48 per cent.), and least largely in Western Australia (27.22 per cent.). In all the States the most prominent place amongst male breadwinners was taken by Primary Producers (25.57 per cent. for the Commonwealth as a whole), followed in each case successively by the Industrial Class (19.88 per cent. for the Commonwealth as a whole), and the Transport and Communication Class (6.66 per cent. for the Commonwealth as a whole).

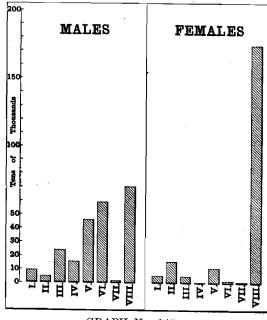
Corresponding particulars in respect of females are furnished in the succeeding table :-

Classes of Occupation, Females. Commonwealth, States and Territories, 1911.

			STA	ATES.			TERRI	TORIES.	
CLASS.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	North- ern.	Federal	C'wlti
			NUMBE	R.					
I. Professional	19,377		6,296	4,616	3,476	2,176	13	8	53,28
II. Domestic	54,524			14,339	9,376	6,487	74	64	154,05
III. Commercial IV. Transport and	18,225	17,355	5,733	4,786	2,941	1,711		3	50,75
Communication	1,597	1,611	621	350	327	999			4.04
V. Industrial	36,115						٠٠,	$\begin{array}{c c} 6 \\ 4 \end{array}$	$\frac{4,84}{109,26}$
VI. Primary Producers	5,297					679	$\begin{array}{c} 4 \\ 12 \end{array}$	24	17,33
VII. Independent	3,401				272	443		1 24	9,11
VIII. Dependents		518,799	227,722				473	612	174331
TOTAL, FEMALES	789,036	659,960	276,307	201,200	120,549	93,620	576	722	214197
	PERCEN	TAGE	ON TOT	FAL FE	MALES.				
I. Professional	2.46	2.63	2.28	2.29	2.88	2.32	2.26	1.11	2.49
II. Domestic	6.91	7.40	7.37	7.13	7.78	6.93	12.85	8.86	7.19
III. Commercial IV. Transport and	2.31	2.63	2.08	2.38	2.44	1.83		.42	2.37
Communication	.20	.24	.22	.17	.27	.36	ľ	.83	.23
V. Industrial	4.58	7.09	4.13	4.15	3.32	2.78	.69	.55	5,10
VI. Primary Producers	.67	.87	1.24	.77	.48	.73	2.08	3.32	.81
VII. Independent :	.43	.53	.26	.38	.23	.47		.14	.42
III. Dependents	82.44	78.61	82.42	82.73	82.60	84.58	82.12	84.77	81.39
TOTAL, FEMALES	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Amongst the States the Professional Class was proportionately most strongly represented amongst the females in Western Australia (2.88 per cent.) and least strongly in Queensland (2.28 per cent.); the Domestic Class most strongly in Western Australia (7.78 per cent.), and least strongly in New South Wales (6.91 per cent.); the Commercial Class most strongly in Victoria (2.63 per cent.), and least strongly in Tasmania (1.83 per cent.); the Transport and Commercial Class most strongly in Tasmania (1.83 per cent.); munication Class most strongly in Tasmania (0.36 per cent.), and least strongly in South Australia (0.17 per cent.); the Industrial Class most strongly in Victoria (7.09 per cent.), and least strongly

Numbers in each Class of Occupation, C'wealth, 1911.



GRAPH No. 145.

in Tasmania (2.78 per cent.); Primary Producers most strongly in Queensland (1.24 per cent.), and least strongly in Western Australia (0.48 per cent.); the Independent Class most strongly in Victoria (0.53 per cent.), and least strongly in Western Australia (0.23 per cent.); and the Dependent Class most strongly in Tasmania (84.58 per cent.), and least strongly in Victoria (78.61 per cent.).

In all the States the most prominent place amongst female breadwinners was taken by the Domestic Class (7.19 per cent. for the Commonwealth as a whole), followed in each case by the Industrial Class (5.10 per cent. for the Commonwealth as a whole), and then by the Professional and Commercial Classes (2.49 per cent. and 2.37 per cent. respectively for the Commonwealth as a whole).

A representation is furnished in Graph No. 145 of the number of persons of each sex in each class of occupation, in the Commonwealth as a whole. The Roman numerals at the feet of the several pillars shown

the significance which attaches to them in the two preceding tables. The scale on the left margin applies to both the male and female portions. The figures shewn on this scale denote the number of tens of thousands of persons represented.

OCCUPATIONS.

7. **Professional Class.**—The occupations which are grouped together for Census purposes, and placed under the general heading of "professional," cover not only the professions of "law, medicine and the church," but include also the army, the navy, and many others, as will be seen from a perusal of the items shewn in the succeeding table. The headings contained therein, constitute what are known in the Census classification, as the sub-orders making up the Professional Class:—

Professional Class. Commonwealth, 1911.

		÷				MA	LES.	FEM	ALES.	Persons.		
		Sui	B-ORDER	s.		No.	Per 1000 of Male Popula- tion.	No.	Per 1000 ofFemale Popula- tion.	No.	Per 1000 of Total Popula- tion.	
General Gov	ernmen	t			•••	 8,818	3.81	608	.28	9,426	2.12	
Local Govern						 3,174	1.37	127	.06	3,301	.74	
Defence						 5,358	2.32			5,358	1.20	
Law and Or	der					 15,242	6.59	824	.38	16,066	3,61	
Religion						 6,707	2.90	1,974	92	8,681	1.95	
Charity, exc	lusive o	f Hos	spitals			 493	.21	1,254	.59	1,747	.39	
Health			•			 14,716	6.36	17,275	8.07	31,991	7.18	
Literature						 2,477	1.07	341	.16	2,818	.63	
Science						 1,045	.45	35	.02	1,080	.24	
Civil Enginee	ring, A	rchite	cture an	d Sur	veving	 7,899	3.42	99	.05	7,998	1.80	
Education	••				٠	 11,469	4.96	20,206	9.43	31,675	7.11	
Fine Arts						 2,752	1.19	2,074	.97	4,826	1.08	
Music						 2,296	.99	7,240	3.38	9,536	2.14	
Amusements			• •	••.		 10,878	4.71	1,227	.57	12,105	2.72	
	Total,	Profe	ssional			 93,324	40.35	53,284	24.88	146,608	32.91	

The occupations included under the head of General Government are those administrative branches of the Public Services of the Commonwealth or the States which do not admit of allocation to the more specific designations included later in the classification. Owing to this arrangement an officer of the Defence Department will be included under "Defence," an officer of the Education Department under "Education," an officer of the Agricultural Department under "Agriculture," an officer of the Railway Department under "Railways," and so on.

Under the heading Defence are included all occupations pertaining to military or naval defence, but exclusive of the manufacture of munitions and the construction of works in connexion with defence.

The occupations included under the heading "Law and Order," are the judicial, the legal, the police and the penal.

The heading "Health" comprises principally medical practitioners, dentists, pharmaceutical chemists and druggists, nurses and veterinary surgeons.

In four of the sub-orders quoted above there was a preponderance of females, viz., Charity, Health, Education and Music.

8. **Domestic Class.**—In the domestic class are grouped all persons engaged in the supply of board and lodging, and in rendering personal service for which remuneration is usually paid. The class has been divided into two sub-orders, of which the former embraces persons engaged in the supply of board and lodging and the latter those engaged in domestic service and attendance. Particulars for the Commonwealth as a whole are as follows:—

Domestic Class. Commonwealth, 1911.

		MA	LES.	FEM	ALES.	Persons.	
SUB-ORDERS.		No.	Per 1000 of Male Popula- tion.	No.	Per 1000 ofFemale Popula- tion.		Per 1000 of Total Popula- tion.
Board and Lodging Domestic Service and Attendance		25,451 23,420	11.00 10.13	39,579 114,475	18.48 53.44	65,030 137,895	14.60 30.95
Total, Domestic Class	•••	48,871	21.13	154,054	71.92	202,925	45.55

In both sub-orders there was a preponderance of females, the ratio of females to males being nearly 3 to 2 in the case of "board and lodging," and nearly 5 to 1 in the case of "domestic service and attendance." The former sub-order comprises the keepers of hotels, coffee palaces, restaurants, boarding houses, lodging houses, &c., and their employees, while the latter includes

all classes of house servants not included under "board and lodging," as well as such other domestic occupations as coachman, groom, and gardener. Hairdressers, barbers, laundrymen, laundresses, washerwomen, and shoeblacks are also included.

9. Commercial Class.—The number and proportion of each sex comprised in the Commercial Class, are shewn in the following table:—

Commercial Class. Commonwealth, 1911.

Dealing in Property and Finance—  Banking and Finance   15,986   6.91	1911.			
Dealing in Property and Finance—  Banking and Finance   15,986   6.91	FEA	IALES.	Рег	sons.
Banking and Finance   15,986   1.9	No.	Per 1000 ofFemale Popula- tion.		Per 1000 of Total Popula- tion.
Banking and Finance				
Landed and House Property   11,478   4.96     Property Rights, N.E.I.   554   24     Dealing in Art and Mechanic Productions—    Books, Publications and Advertising   4,224   1.83     Musical Instruments   996   43     Prints, Pictures and Art Materials   280   1.2     Ornaments and Small Wares   635   2.7     Equipment for Sports and Games   100   0.4     Designs, Medals, Type and Dies   61   0.3     Watches, Clocks, Jewellery, &c.   1,360   59     Surgical Instruments and Appliances   88   0.4     Arms, Ammunition and Explosives   33   0.1     Machines, Tools and Implements   2,630   1.14     Carriages and Vehicles   809   3.5     Harness, Saddlery and Leatherware   360   1.6     Ships and Boats, their Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and Supplies   884   43     Equipment and House Fittings   884   43     Equipment and Supplies   884   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Equipment and Explosives   984   43     Eq	1,456	.68	17,442	3.92
Property Rights, N.E.I.   554   24   Dealing in Art and Mechanic Productions— Books, Publications and Advertising   4,224   1.83   Musical Instruments   996   .43   Prints, Pictures and Art Materials   280   .12   27   27   27   28   28   .12   28   27   28   27   29   27   27   27   27   27   27	914	.43	11,748	2.64
Dealing in Art and Mechanic Productions—  Books, Publications and Advertising	5,155	2.41	16,633	3.73
Books, Publications and Advertising   4,224   1.83	84	.04	638	.14
Musical Instruments         996         4.3           Prints, Pictures and Art Materials         280         1.2           Ornaments and Small Wares         635         27           Equipment for Sports and Games         100         .04           Designs, Medals, Type and Dies         61         .03           Watches, Clocks, Jewellery, &c.         1,360         .59           Surgical Instruments and Appliances         88         .04           Arms, Ammunition and Explosives         33         .01           Machines, Tools and Implements         2,630         1.14           Carriages and Vehicles         809         .35           Harness, Saddlery and Leatherware         360         .16           Ships and Boats, their Equipment and Supplies         884         .38           Furniture         2,357         1.02           Chemicals and By-Products         984         .38           Furniture         2,357         1.02           Chemicals and By-Products         984         .43           Paper, Papermakers' Materials, Stationery         1,709         .74           Dealing in Textile Fabrics, Dress and Fibrous         19,131         8.27           Dress         1         4,463         1.93	1,140	.53	5,364	1.20
Prints, Pictures and Art Materials         280         .12           Ornaments and Small Wares         635         .27           Equipment for Sports and Games         100         .04           Designs, Medals, Type and Dies         61         .03           Watches, Clocks, Jewellery, &c.         1,360         .59           Surgical Instruments and Appliances         88         .04           Arms, Ammunition and Explosives         33         .01           Machines, Tools and Implements         2,630         1.14           Carriages and Vehicles         809         .35           Harness, Saddlery and Leatherware         360         .16           Ships and Boats, their Equipment and Supplies         366         .13           Building Materials and House Fittings         366         .13           Building Materials and House Fittings         884         .38           Furniture         2,357         .102           Chemicals and By-Products         984         .43           Paper, Papermakers' Materials, Stationery         17.709         .74           Dealing in Textile Fabrics         19,131         8.27           Dress         19,131         8.27           Dress         19,131         8.27	268	.12	1,264	.28
Ornaments and Small Wares         635         27           Equipment for Sports and Games         100         .04           Designs, Medals, Type and Dies         61         .03           Watches, Clocks, Jewellery, &c.         1,360         .59           Surgical Instruments and Appliances         88         .04           Arms, Ammunition and Explosives         33         .01           Machines, Tools and Implements         2,630         1.14           Carriages and Vehicles         809         .35           Harness, Saddlery and Leatherware         360         .16           Ships and Boats, their Equipment and Supplies         884         .38           Furniture         2,357         1.02           Chemicals and By-Products         984         .38           Furniture         2,357         1.02           Chemicals and By-Products         984         .43           Paper, Papermakers' Materials, Stationery         1,709         .74           Dealing in Textile Fabrics, Dress and Fibrous         19,131         8.27           Textile Fabrics         19,131         8.27           Dress         1,463         1,93           Fibrous Materials         164         .07 <td< td=""><td>98</td><td>.05</td><td>378</td><td>.09</td></td<>	98	.05	378	.09
Designs, Medals, Type and Dies	762	.36	1,397	.31
Watches, Clocks, Jewellery, &c.         1,360         .59           Surgical Instruments and Appliances         88         .04           Arms, Ammunition and Explosives         33         .01           Machines, Tools and Implements         2,630         1.14           Carriages and Vehicles         809         .35           Harness, Saddlery and Leatherware         360         .16           Ships and Boats, their Equipment and Supplies         306         .13           Building Materials and House Fittings         884         .38           Furniture         2,357         1.02           Chemicals and By-Products         984         .43           Paper, Papermakers' Materials, Stationery         1,709         .74           Dealing in Textile Fabrics, Dress and Fibrous         1,709         .74           Dealing in Food, Drinks, Narcotics & Stimulants         164         .07           Dealing in Food, Drinks, Narcotics & Stimulants         164         .07           Dealing in Animals and in Animal and Vegetable         30,623         13.24           Vegetable Food         11,386         4.92           Groceries, Drinks, Narcotics, Stimulants         26,218         11.33           Dealing in Animals and in Animal and Vegetable         54	2		102	.02
Surgical Instruments and Appliances	5	· · ·	66	.01
Arms, Ammunition and Explosives         33         .01           Machines, Tools and Implements         2,630         .14           Carriages and Vehicles         809         .35           Harness, Saddlery and Leatherware         360         .16           Ships and Boats, their Equipment and Supplies         306         .13           Building Materials and House Fittings         884         .38           Furniture         2,357         1.02           Chemicals and By-Products         984         .43           Paper, Papermakers' Materials, Stationery         1,709         .74           Dealing in Textile Fabrics, Dress and Fibrous         19,131         8.27           Materials—         19,131         8.27           Dress         1,463         1.93           Fibrous Materials         19,131         8.27           Dress         1,463         1.93           Fibrous Materials         1,236         1.93           Fibrous Materials         1,236         1.93           Fibrous Materials         1,236         1.324           Vegetable Food         1,1,386         4.92           Groceries, Drinks, Narcotics, Stimulants         26,218         11.33           Dealing in Animals	337	.16	1,697	.38
Machines, Tools and Implements         2,630         1.14           Carriages and Vehicles         809         .35           Harness, Saddlery and Leatherware         360         .13           Ships and Boats, their Equipment and Supplies         306         .13           Building Materials and House Fittings         884         .38           Furniture         2,357         1.02           Chemicals and By-Products         984         .43           Paper, Papermakers' Materials, Stationery         1,709         .74           Dealing in Textile Fabrics, Dress and Fibrous         Materials         1,709         .74           Dealing in Textile Fabrics, Dress and Fibrous         19,131         8.27           Dress         1,463         1.93         1.93           Fibrous Materials         164         .07           Dealing in Food, Drinks, Narcotics & Stimulants         30,623         13.24           Vegetable Food         30,623         11,386         4.92           Groceries, Drinks, Narcotics, Stimulants         26,218         11.33           Dealing in Animals and in Animal and Vegetable         54         .02           Leather, Raw Materials and Manufactures         54         .02           Leather, Raw Materials and Manufacture	14	.01	102	.02
Carriages and Vehicles         809         .35           Harness, Saddlery and Leatherware         360         .16           Ships and Boats, their Equipment and Supplies         306         .13           Building Materials and House Fittings         884         .38           Furniture          2,357         1.02           Chemicals and By-Products         984         .43           Paper, Papermakers' Materials, Stationery         1,709         .74           Dealing in Textile Fabrics, Dress and Fibrous         1,709         .74           Materials—         19,131         8.27           Dress          4,463         1.93           Fibrous Materials          164         .07           Dealing in Food, Drinks, Narcotics & Stimulants—         30,623         13.24           Animal Food          11,386         4.92           Groceries, Drinks, Narcotics, Stimulants         26,218         11.33           Dealing in Animals and in Animal and Vegetable         Substances, N.E.I.—         4,239         1.83           Manures and Animal Waste Products         54         .02         1.236           Wool and other Animal Matters         3,477         1.50           Seeds,	2 221	1.5	35	.01
Harness, Saddlery and Leatherware   360   306   313     Ships and Boats, their Equipment and Supplies   884   38     Building Materials and House Fittings   884   38     Furniture	331 70	.15	$2,961 \\ 879$	.67 .20
Ships and Boats, their Equipment and Supplies Building Materials and House Fittings	20	.01	380	.09
Building Materials and House Fittings	13	.01	319	.07
Furniture          2,357         1.02           Chemicals and By-Products          984         .43           Paper, Papermakers' Materials, Stationery         1,709         .74           Dealing in Textile Fabrics, Dress and Fibrous             Materials—          19,131         8.27           Dress               Fibrous Materials               Dealing in Food, Drinks, Narcotics & Stimulants—         30,623         13.24           Vegetable Food            11,386         4.92           Groceries, Drinks, Narcotics, Stimulants         26,218         11.33           Dealing in Animals and in Animal and Vegetable         Substances, N.E.I.—          54         .02           Leather, Raw Materials and Manufactures         1,236          .53           Wool and other Animal Matters         3,477         1.50           Seeds, Plants, Flowers, Fodder, &c.         5,576         2.41           Other Vegetable Matters, N.E.I.         6,883         2.98           Dealing in Metals and other Minerals—         5,564         2.41	77	.04	961	.22
Chemicals and By-Products         984         .43           Paper, Papermakers' Materials, Stationery         1,709         .74           Dealing in Textile Fabrics, Dress and Fibrous         19,131         8.27           Materials—         19,131         8.27           Dress          164         .07           Dealing in Food, Drinks, Narcotics & Stimulants—Animal Food          30,623         13,24           Vegetable Food           11,386         4.92           Groceries, Drinks, Narcotics, Stimulants         26,218         11.33           Dealing in Animals and in Animal and Vegetable         26,218         11.33           Substances, N.E.I.—          54         .02           Living Animals           54         .02           Leather, Raw Materials and Manufactures          54         .02           Leather, Raw Materials and Manufactures          3,477         1.50           Seeds, Plants, Flowers, Fodder, &c.          5,576         2.41           Other Vegetable Matters, N.E.I.          6,883         2.98           Dealing in Metals and other Minerals—Stone, Clay, Earthenware, Glass, &c. <t< td=""><td>400</td><td>.19</td><td>2,757</td><td>.62</td></t<>	400	.19	2,757	.62
Dealing in Textile Fabrics, Dress and Fibrous   Materials   Materials   19,131   8.27	273	.13	1,257	.28
Materials—           Textile Fabrics         19,131         8.27           Dress          4,463         1.93           Fibrous Materials          164         .07           Dealing in Food, Drinks, Narcotics & Stimulants—         30,623         13.24           Vegetable Food          11,386         4,92           Groceries, Drinks, Narcotics, Stimulants         26,218         11.33           Dealing in Animals and in Animal and Vegetable         26,218         11.33           Substances, N.E.I.—         4,239         1.83           Living Animals         4,239         1.83           Manures and Animal Waste Products         54         .02           Leather, Raw Materials and Manufactures         1,236         .53           Wool and other Animal Matters         3,477         1.50           Seeds, Plants, Flowers, Fodder, &c.         5,576         2.41           Other Vegetable Matters, N.E.I.         6,883         2.98           Dealing in Fuel and Light—         6,883         2.98           Dealing in Metals and other Minerals—         5,564         2.41           Dealing in Metals and other Minerals—         106         .05           Stone, Clay, Earthenware,	848	.40	2,557	.57
Textile Fabrics   19,131   8.27				
Dress	10.710	<b>504</b>	91.040	F 15
Fibrous Materials	12,718 $1,543$	5.94	31,849 6,006	7.15 1.35
Dealing in Food, Drinks, Narcotics & Stimulants—  Animal Food	1,545		174	.04
Animal Food	-0		1	.01
Vegetable Food             26,218         11.33           Dealing in Animals and in Animal and Vegetable Substances, N.E.I.—	1,476	.69	32,099	7.21
Dealing in Animals and in Animal and Vegetable Substances, N.E.I.—         4,239         1.83           Living Animals           4,239         1.83           Manures and Animal Waste Products          54         .02           Leather, Raw Materials and Manufactures          1,236         .53           Wool and other Animal Matters          3,477         1.50           Seeds, Plants, Flowers, Fodder, &c.          5,576         2.41           Other Vegetable Matters, N.E.I.          6,883         2.98           Dealing in Fuel and Light—          5,564         2.41           Dealing in Metals and other Minerals—          5,564         2.41           Dealing in Metals and other Minerals—           5,564         2.41           Dealing in Metals and Other Minerals—	4,207	1.96	15,593	3.50
Substances, N.E.I.—       4,239       1.83         Living Animals         54       .02         Leather, Raw Materials and Manufactures       1,236       .53         Wool and other Animal Matters        3,477       1.50         Seeds, Plants, Flowers, Fodder, &c.        5,576       2.41         Other Vegetable Matters, N.E.I.        6,883       2.98         Dealing in Fuel and Light—        5,564       2.41         Coal, Firewood, Kerosene, &c.        5,564       2.41         Dealing in Metals and other Minerals—        5,564       2.41         Stone, Clay, Earthenware, Glass, &c.        1,355       .59         Gold, Silver and Precious Stones        106       .05         Metals other than Gold and Silver         7,826       3.38         General and Undefined Merchants and Dealers—        Merchants, Dealers (undefined)        43,659       18.88         Other Mercantile Persons        10,135       4.38         Speculators on Chance Events—        1,291          Lottery-keepers,Sweep promoters,Bookmakers,&c.       1,291	2,976	1.39	29,194	6.55
Living Animals       4,239       1.83         Manures and Animal Waste Products       54       .02         Leather, Raw Materials and Manufactures       1,236       .53         Wool and other Animal Matters       3,477       1.50         Seeds, Plants, Flowers, Fodder, &c.       5,576       2.41         Other Vegetable Matters, N.E.I.       6,883       2.98         Dealing in Fuel and Light—       6,883       2.98         Coal, Firewood, Kerosene, &c.       5,564       2.41         Dealing in Metals and other Minerals—       5,564       2.41         Stone, Clay, Earthenware, Glass, &c.       1,355       .59         Gold, Silver and Precious Stones       106       .05         Metals other than Gold and Silver       7,826       3.38         General and Undefined Merchants and Dealers—       43,659       18.88         Other Mercantile Persons       10,135       4.38         Speculators on Chance Events—       1,291       .56         Lottery-keepers,Sweep promoters, Bookmakers, &c.       1,291       .56				ļ
Manures and Animal Waste Products       54       .02         Leather, Raw Materials and Manufactures       1,236       .53         Wool and other Animal Matters       3,477       1.50         Seeds, Plants, Flowers, Fodder, &c.       5,576       2.41         Other Vegetable Matters, N.E.I.       6,883       2.98         Dealing in Fuel and Light—       5,564       2.41         Coal, Firewood, Kerosene, &c.       5,564       2.41         Dealing in Metals and other Minerals—       5,564       2.41         Stone, Clay, Earthenware, Glass, &c.       1,355       .59         Gold, Silver and Precious Stones       106       .05         Metals other than Gold and Silver       7,826       3.38         General and Undefined Merchants and Dealers—       43,659       18.88         Other Mercantile Persons       10,135       4.38         Speculators on Chance Events—       1,291       .56         Engaged in Storage—       .56	94	.04	4,333	.97
Leather, Raw Materials and Manufactures       1,236       .53         Wool and other Animal Matters       3,477       1.50         Seeds, Plants, Flowers, Fodder, &c.       5,576       2.41         Other Vegetable Matters, N.E.I.       6,883       2.98         Dealing in Fuel and Light—       5,564       2.41         Coal, Firewood, Kerosene, &c.       5,564       2.41         Dealing in Metals and other Minerals—       1,355       .59         Gold, Silver and Precious Stones       106       .05         Metals other than Gold and Silver       7,826       3.38         General and Undefined Merchants and Dealers—       43,659       18.88         Other Mercantile Persons       10,135       4.38         Speculators on Chance Events—       1,291       .56         Lottery-keepers,Sweep promoters,Bookmakers,&c.       1,291       .56	ī	1	55	.01
Wool and other Animal Matters       3,477       1.50         Seeds, Plants, Flowers, Fodder, &c.       5,576       2.41         Other Vegetable Matters, N.E.I.       6,883       2.98         Dealing in Fuel and Light—       5,564       2.41         Coal, Firewood, Kerosene, &c.       5,564       2.41         Dealing in Metals and other Minerals—       1,355       59         Gold, Silver and Precious Stones       106       0.5         Metals other than Gold and Silver       7,826       3.38         General and Undefined Merchants and Dealers—       43,659       18.88         Other Mercantile Persons       10,135       4.38         Speculators on Chance Events—       1       1,291       .56         Engaged in Storage—	36	.02	1,272	.29
Other Vegetable Matters, N.E.Í	94	,04	3,571	.80
Dealing in Fuel and Light— Coal, Firewood, Kerosene, &c	583	.27	6,159	1.38
Coal, Firewood, Kerosene, &c	154	.07	7,037	1.58
Dealing in Metals and other Minerals—Stone, Clay, Earthenware, Glass, &c	101	0.5	F 00F	1.05
Stone, Clay, Earthenware, Glass, &c 1,355 Gold, Silver and Precious Stones 106 Metals other than Gold and Silver	101	.05	5,665	1.27
Gold, Silver and Precious Stones	225	.11	1,580	.36
Metals other than Gold and Silver	9		115	.03
General and Undefined Merchants and Dealers— Merchants, Dealers (undefined)	438	.20	8,264	1.85
Other Mercantile Persons				
Speculators on Chance Events— Lottery-keepers, Sweep promoters, Bookmakers, &c. 1,291 Engaged in Storage— .56	10,170	4.75	53,829	12.08
Lottery-keepers, Sweep promoters, Bookmakers, &c. 1,291 Engaged in Storage—	3,601	1.68	13,736	3.08
Engaged in Storage—	, ,,	0.0	1 000	
Engaged in Storage—	41	.02	1,332	.30
Store proprietors and hands 558 .24	8		566	.13
Total, Commercial Class	50,754	-	291,366	65.40

An unsatisfactory feature of this Class is the relatively large number included under the indefinite order "General and undefined merchants." Included in this order were 53,794 males and 13,771 females, or about 22 per cent. and 27 per cent. of the totals for each sex in the Commercial Class. These persons consisted mainly of those who stated their occupations as "merchant," "importer," "warehouseman," "storekeeper," "dealer," "hawker," "agent," without any specification of the nature of the commodities dealt in. In only one sub-order ("dealing in ornaments and small wares") was there a preponderance of females.

10. Transport and Communication Class.—Occupations associated with the transport of passengers and goods by rail, road or water, and with the effecting of communications by post, telegraph or telephone are grouped together under the Class which has been designated "Transport and Communication." The number and proportion of each sex comprised in this class is shewn in the following table:—

Transport and Communication Class. Commonwealth, 1911.

	MA	ALES.	Fем	ALES.	Persons.	
Sub-orders.	No.	Per 1000 of Male Popula- tion.	No.	Per 1000 of Female Popula- tion.	1	Per 1000 of Total Popula- tion.
On Railways (not construction)	50,416	21.80	891	.42	51,307	11.52
On Roads	43,181	18.67	209	.10	43,390	9.74
On Seas and Rivers and the regulation thereof	43,098	18.63	386	.18	43,484	9.76
On Postal Service	9,044	3.91	2,058	.96	11,102	2.49
On Telegraph and Telephone Service	7,739	3.34	1,297	.60	9,036	2.03
Delivery of Documents, Parcels & Messages by hand	531	.23	4		535	.12
Total, Transport and Communication Class	154,009	66.58	4,845	2.26	158,854	35.66

Of the males employed on railways, 9,277, or about  $18\frac{1}{2}$  per cent. were engine men, *i.e.*, were engine drivers, firemen, or cleaners. Of the males employed on roads, 9,643 or about  $22\frac{1}{4}$  per cent. were occupied in connexion with tramway services.

In all the sub-orders of this Class the males greatly predominated.

11. Industrial Class.—The industrial class comprised 569,132 persons, of whom 459,871 were males and 109,261 were females. The number and proportion in each sub-order of this class are shewn in the following table:—

Industrial Class. Commonwealth, 1911.

	Ма	LES.	FEM	IALES.	PER	sons.
ORDERS AND SUB-ORDERS.	No.	Per 1000 of Male Popula- tion.	No.	Per 1000 ofFemale Popula- tion.		Per 1000 of Total Popula- tion.
Working in Art and Mechanic Productions—						
Books and Publications	16,540	7.15	3,993	1.87	20,533	4.61
Musical Instruments	1,178	.51	54	.03	1,232	.28
Prints, Pictures and Art Materials	1,769	.77	179	.08	1,948	.44
Ornaments and Small Wares	2,155	.93	2,045	.96	4,200	.94
Electronic de Constant de la Constan	171	.07	2,043	.02	215	.05
TOTAL TOTAL TOTAL TOTAL	485	.21	43	.02	528	.03
	2.513	1.09	82			.58
Watches, Clocks and Scientific Instruments				.04	2,595	
Surgical Instruments and Appliances	103	.04	34	.02	137	.03
Arms, Ammunition, and Explosives	289	.12	203	.09	492	.11
Engines, Machines, Tools and Implements	25,078	10.84	132	.06	25,210	5.66
Carriages and Vehicles	16,861	7.29	104	.05	16,965	3.81
Harness, Saddlery and Leatherware	7,122	3.08	435	.20	7,557	1.70
Ships, Boats and their Equipment	3,567	1.54	21	.01	3,588	.80
Furniture	10,753	4.65	$\bf 562$	.26	11,315	2.54
Building materials and other manufactures,	·			_		_
mainly of Timber	10,493	4.54	38	.02	10,531	2.36
Chemicals and By-products	2,772	1.20	558	.26	3,330	.75
Working in Textile Fabrics, Dress and Fibrous  Materials—	*					
Textile Fabrics	1,735	.75	1,894	.88	3,629	.81
Dress	31,218	13.50	87,508	40.85	118,726	26,65
Fibrous Materials	1,163	.50	468	.22	1,631	.37
Working in Food, Drinks, Narcotics, & Stimulants	1,100	.50	±00	.22	1,001	
	9,996	4.32	341	.16	10,337	2.32
		11.90	3,949	1.84	31,482	7.07
	27,533					
Groceries, Drinks, Narcotics and Stimulants	10,946	4.73	2,213	1.03	13,159	2.95
Working in Animal & Vegetable Substances, N.E.I.	E 00E	0.00	961	10	H 050	1 50
Animal Matters, N.E.I	7,397	3.20	261	.12	7,658	1.72
Vegetable Matters, N.E.I.	4,227	1.83	273	.13	4,500	1.01
Vegetable Produce for Fodder	1,147	.50	3		1,150	.26
Paper Manufacture	<b>296</b>	.13	76	.04	372	.08
Working in Metals and other Minerals—			100			
Stone, Clay, Earthenware, Glass, &c	11,658	5.04	132	.06	11,790	2.65
Jewellery, Precious Stones and Minting	3,211	1.39	<b>242</b>	.11	3,453	.77
Workers in various Metals, N.E.I	38,854	16.80	203	.09	39,057	8.77
Working in Fuel, Light and other Forms of Energy				<u>.</u>	_	
Gas, Electric Light and Power, &c	10,242	4.43	377	.18	10,619	2.38
Constructing Buildings, Roads, Railways, &c.—				Ĭ		
Houses and Buildings	85,822	37.10	102	.05	85,924	19.29
Roads, Railways, Earthworks, &c	27,391	11.84	5		27,396	6.15
Disposing of the Dead or of Refuse—		Į l		\		
Disposal of the Dead	1,040	.45	34	.02	1,074	.24
Disposal of Refuse	5,176	2.24	1	}	5,177	1.16
Engaged in Undefined Industrial Pursuits—	-					
Imperfectly Defined	78,970	34.14	2,652	1.24	81,622	18.32
Total, Industrial Class	459,871	198.82	109,261	<b>71.01</b>	569,132	127,75

The imperfectly defined industrial male workers who comprised about 17 per cent. of the total industrial males consisted mainly of persons whose occupation was stated as "labourer," without any indication of the class of industry with which they were connected. The other indefinite designations which contributed most largely to the total were "mechanic," "apprentice," "engine driver," "machinist," "manager," and "foreman." In all the sub-orders except two, viz., "Textile Fabrics," and "Dress," there was a heavy preponderance of males, but in these two females predominated.

The construction of buildings and of roads, railways and earthworks accounted together 113,213 males, being about 4.89 per cent. of the total male population, or 24.62 per cent. of the total industrial males. The metal-working industry ranked next in importance amongst industrial males, a total of 63,932 being obtained by adding the kindred sub-orders, "Workers in various metals, N.E.I.," and "Engines, machines, tools, and implements." This total represents metals, N.E.I.," and "Engines, machines, tools, and implements." This total represents 2.76 per cent. of the male population, and 13.90 per cent. of industrial males. Next in importance as a group of industrial male workers are those engaged in production of food, drink, narcotics and stimulants. These totalled 48,475, representing 2.10 per cent. of the total male population, and 10.54 per cent. of the industrial males. The next group in importance amongst males is that comprised of the workers in textile fabrics, dress and fibrous materials who totalled 34,116, representing 1.48 per cent. of the total male population, and 7.42 per cent. of industrial males. Male workers in carriages and vehicles totalled 16,861; in books and publications, 16,540; in stone, clay, earthenware, glass, &c., 11,658; in furniture, 10,753; in building materials (mainly timber) 10,493; and in the production of light and power 10,242. Amongst the female industrial workers the only sub-order strongly represented was that of "dress" which included 87,508 females, representing 4.09 per cent. of the total female population, and over 80 per cent. of the industrial females. Female workers in food, drink, narcotics and stimulants totalled 6,503, in books and publications 3,993, in ornaments and small wares 2,045, in textile fabrics 1,894, while 2,652, mainly "machinists," were included as "imperfectly defined." It may be noted the item "dress," as used above, covers a wide range of occupations, the principal ones included being tailoring, dressmaking, hat and cap making, millinery and bootmaking.

12. **Primary Producing Class.**—The Class of Primary Producers was that most largely represented in the Australian population and included 608,843 persons, of whom 591,505 were males and 17,338 females. The number and proportion in each sub-order are shewn in the following table:—

Primary	Producers.	Commonwealth,	1911.

			Ma	LES.	Fем	ALES.	PER	sons.
Sub-orders,			No.	Per 1000 of Male Popula- tion.	No.	Per 1000 ofFemale Popula- tion.		Per 1000 of Total Popula- tion.
Agricultural Pursuits			287,556	124.32	8,154	3.81	295,710	66.38
Destar 1 Deservite	• •	• •	148,938	64.39	9,029	4.21	157.967	35.46
TI	• •	• •	4,946	2.14	27	.01	4,973	1.11
Dial alia	• •	• •	8,085	3.50	11		8,096	1.82
1714		• •	25,302	10.94	13	.01		
W-t - O	• •	• •			19		25,315	5.68
	• •		7,015	3.03		.01	7,034	1.58
Mines and Quarries	• •	• •	109,663	47.41	85	.04	109,748	24.63
Total, Primary Producers			591,505	255.73	17,338	8.09	608,843	136.66

In all the sub-orders comprised under the class of primary producers, the males greatly predominated. The females contained in the agricultural and pastoral sub-orders consisted mainly of female proprietors, or of female members of the farmers' families assisting without wages in connexion with the dairy work of the farm. In the other sub-orders the number of females was practically negligible. The principal occupations included under the head of agricultural pursuits are those of farmer, market gardener, fruitgrower, vigneron, sugar planter, nurseryman, and their assistants. The heading, "pastoral pursuits," covers principally station proprietors, dairy farmers, poultry farmers and their assistants. The principal occupation under the head of "hunting" was that of rabbit-trapping. In the mining sub-order, gold, coal, silver, copper and tin in the order mentioned were the minerals which furnished the largest amount of employment.

13. Commonwealth Comparisons with Previous Censuses.—The following table furnishes a comparison of the numbers and proportions of each sex in each of the classes of occupation at the Censuses of 1891, 1901 and 1911:—

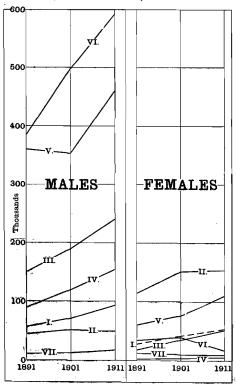
Commonwealth Population in Occupation Classes, 1891, 1901 and, 1911.

			MALES.			FEMALES.			Persons	
	Class.	1891,	1901.	1911.	1891.	1901.	1911.	1891.	1901.	1911.
				NUM	IBER.					
II. IV. VI. VII.	Professional Domestic Commercial Transport & Communication Industrial Primary Producers Independent Dependents ALL CLASSES	57,579 44,677 149,891 89,903 359,726 385,214 10,766 606,283	70,702 50,541 189,285 119,254 352,860 496,654 12,294 686,338 1,977,928	93,324 48,871 240,612 154,009 459,871 591,505 17,286 707,557 2,313,035	27,308 113,974 17,762 2,729 59,719 34,285 12,360 1,202,216	41,654 151,675 34,743 3,448 76,152 39,112 10,136 1,438,953	53,284 154,054 50,754 4,845 109,261 17,338 9,116 1,743,318 2,141,970	84,887 158,651 167,653 92,632 419,445 419,499 23,126 1,808,499 3,174,392	112,356 202,216 224,028 122,702 429,012 535,766 22,430 2,125,291 3,773,801	569,132 608,843
		PROI	PORTION	PER CEN	T. ON AL	L CLASSE	is.			
II. IV. VI. VII.	Professional Domestic Commercial Transport & Communication Industrial Primary Producers Independent Dependents ALL CLASSES	3.38 2.62 8.80 5.28 21.11 22.60 .63 35.58	3.57 2.56 9.57 6.03 17.84 25.11 .62 34.70	4.04 2.11 10.40 6.66 19.88 25.57 .75 30.59	1.86 7.75 1.21 .19 4.06 2.33 .84 81.76	2.32 8.45 1.93 .19 4.24 2.18 .56 80.13	2.49 7.19 2.37 .23 5.10 .81 .42 81.39	2.67 5.00 5.28 2.92 13.21 13.22 .73 56.97	2.98 5.36 5.94 3.25 11.37 14.20 .59 56.31	3.29 4.55 6.54 3.57 12.78 13.67 .59 55.01

In the case of males each of the classes of occupation, with the exception of the Industrial Class, contained a larger number in 1901 than in 1891, and each, with the exception of the Domestic Class, contained a larger number in 1911 than in 1901. Amongst females each class except the Independent Class, was numerically stronger in 1901 than in 1891, and each, except Primary Producers and Independent, was numerically stronger in 1911 than in 1901.

An interesting fact brought out by the proportion table is the continuous increase in the proportion of males engaged as primary producers, from 22.60 per cent. in 1891 to 25.11 per cent. in 1901, and 25.57 per cent. in 1911. On the other hand the Industrial males fell from 21.11

Variations in Numbers in each Occupation Class, Commonwealth, 1891 to 1911.



GRAPH No. 146.

per cent. in 1891 to 17.84 per cent. in 1901, but rose again to 19.88 per cent. in 1911. Amongst males the Professional, the Commercial and the Transport and Communication Classes represented increasing proportions of the male population from Census to Census while the Domestics, and the Dependent Classes represented diminishing proportions.

At each of the three Censuses the numerical strength of the several classes of male bread-winners was in the following order:—(i.) Primary Producers; (ii.) Industrial; (iii.) Commercial; (iv.) Transport and Communication; (v.) Professional; (vi.) Domestic; and (vii.) Independent.

At each of these Censuses the Domestic Class was numerically the strongest amongst female breadwinners, the Industrial Class ranking second in each case. The proportion of women in the Professional, Commercial, Transport and Communication and Industrial Classes, increased continuously from Census to Census, but the proportions in the other four Classes were lower in 1911 than in 1891.

The accompanying Graph (No. 146) furnishes an indication for each sex of the manner in which the numbers in each class have varied during the twenty years, 1891-1911. For convenience and clearness in representation of the more important classes, the particulars respecting Class VIII., Dependents, have been omitted. The scale on the left of the Graph represents "thousands" of

persons, and is applicable to both the male and the female portions. The Roman numerals on the Graph refer to the several occupation classes, and have the significance indicated in the preceding table.

14. **Grades of Occupation.**—As indicated in Section 2 of the present Chapter (p. 347), an inquiry was made in each case concerning the grade of the occupation followed by each person enumerated, each person being asked to indicate such grade by the insertion of a specified letter. Thus E was used to denote a person employing labour in the occupation which he stated that he

was following. O was used to denote a person working on his own account without employing others in his business. A denoted a person assisting the head of the establishment in his business without receiving salary or wages. W denoted a person in receipt of salary or wages, while N was used to denote a person who was out of work at the date of the Census, and who had been so for more than a week prior to that date. In addition to these cases there were others in which the question of grade was not applicable, as for example in the cases of (i.) certain inmates of religious and charitable institutions; (ii.) persons unable to follow their usual occupations through ill-health; (iii.) persons of independent means not following any occupation; (iv.) dependents. The cards for these and similar persons were marked N A (not applicable) in respect of grade. There were also others concerning whom the grade was not stated on the cards, and the information furnished did not indicate clearly that the grade N A was appropriate. For tabulation purposes these were graded N S (not specified), the data being subsequently distributed pro rata for the purposes of the present Chapter, as mentioned in Section 4 (p. 349). On the occasion of the Census of 1911, very full particulars were tabulated in respect of grade in conjunction with age and nature of occupation. Tables 18 and 19 of Part XII., Occupations, contain complete details of this nature for each sex (see Volume III., pp. 1326-1527). At the Census of 1891 all the States except Queensland and Western Australia published particulars of grade in conjunction with occupation, and at the Census of 1901 similar information was published by all the States except Queensland.

15. Classes and Grades in 1911.—In the following table is furnished an analysis of the occupations of males according to class and grade in conjunction, for the Commonwealth as a whole :—

Grade of Occupation of Males in each Class. Commonwealth, 1911.

_		G	RADE OF (	Occupation	Ň.		ALL
Class.	E.	0.	Α.	w.	ર <b>ૂ N</b> .	N.A.	GRADES.
		NUM	BER.		,	<b>&amp;</b> ?	
I. Professional II. Domestic III. Commercial IV. Transport & Communication V. Industrial VI. Primary Producers	7,658 8,887 32,890 5,563 40,834 108,381	8,034 3,328 26,117 8,223 17,496 85,229	127 661 2,028 767 1,737 59,051	64,545 32,355 158,686 132,023 355,215 313,581	1,021 1,921 5,398 3,577 24,325 11,755	11,939 1,719 15,493 3,856 20,264 13,508	93,324 48,871 240,612 154,009 459,871 591,505
VII. Independent VIII. Dependents						17,286 707,557	17,286 707,557
ALL CLASSES	204,213	148,427	64,371	1,056,405	47,997	791,622	2,313,035
PRO	PORTION	PER CEI	NT. ON A	LL GRAD	ES.		
I. Professional II. Domestic III. Commercial IV. Transport & Communication V. Industrial VI. Primary Producers	8.21 18.18 13.67 3.61 8.88 18.32	8.61 6.81 10.86 5.34 3.80 14.41	.14 1.35 .84 .50 .38 9.98	69.16 66.21 65.95 85.73 77.24 53.02	1.09 3.93 2.24 2.32 5.29 1.99	12.79 3.52 6.44 2.50 4.41 2.28	100.00 100.00 100.00 100.00 100.00
VII. Independent VIII. Dependents	•••	• • •	· · · · · · · · · · · · · · · · · · ·	••	::	100.00	100.00
ALL CLASSES	8.83	6.42	2.78	45.67	2.08	34.22	100.00
PRO	PORTION	PER CEI	NT. ON A	LL CLASS	ES.		
I. Professional II. Domestic III. Commercial IV. Transport & Communication V. Industrial VI. Primary Producers VII. Independent VIII. Dependents	3.75 4.35 16.11 2.72 20.00 53.07	5.41 2.24 17.60 5.54 11.79 57.42	.20 1.03 3.15 1.19 2.70 91.73	6.11 3.06 15.02 12.50 33.63 29.68	2.13 4.00 11.25 7.45 50.68 24.49	1.51 .22 1.96 .49 2.56 1.70 2.18 89.38	4.04 2.11 10.40 6.66 19.88 25.57 .75 30.59
ALL CLASSES	100.00	100.00	100.00	100.00	100.00	100.00	100.00

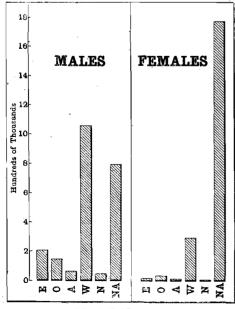
In each class of occupation, wage earners were more numerous than any other grade. Employers ranked second, and workers on own account third in the Domestic, the Commercial, and the Primary Producers Classes. Workers on own account ranked second, and employers third in the Transport and Communication Class. In the Industrial Class employers ranked second and the unemployed third, while in the Professional Class, those to whom grade was not applicable ranked second and workers on own account third.

Corresponding particulars concerning the class and grade of female occupations are furnished in the following table :—  $\,$ 

Grade of Occupation of Females in each Class. Commonwealth, 1911.

		G	RADE OF	Occupatio:	N		ALL
CLASS.	E.	0.	Α.	w.	N.	N.A.	GRADES
		NUM	BER.				
I. Professional II. Domestic III. Commercial IV. Transport & Communication	878 5,343 2,875 98	12,726 5,214 5,605 11	205 2,248 2,435 14	31,926 133,262 33,375	726 4,656 865 16	6,823 3,331 5,599 24	53,284 154,054 50,754 4,845
V. Industrial	4,349 5,110	$10,715 \\ 2,463$	668 8,486	4,682 $90,597$ $1,193$	2,017 5	915 81 9,116	109,261 17,338
VIII. Dependents	• • •	• •	::	••		1,743,318	9,116 1,743,318
ALL CLASSES	18,653	36,734	14,056	295,035	8,285	1,769,207	2,141,970
I. Professional	1.65	23.88	.38	59.92	1.36	12.81	100.00
I. Professional	1.65	23.88	.38	59.92	1.36		
I. Professional	1.65 3.47 5.67 2.02 3.98	23.88 3.39 11.04 .23 9.81	.38 1.46 4.80 .29 .61	59.92 86.50 65.76 96.64 82.92	1.36 3.02 1.70 .33 1.84	2.16 11.03 .49 .84	100.00 100.00 100.00 100.00
I. Professional II. Domestic III. Commercial IV. Transport & Communication V. Industrial VI. Primary Producers VII. Independent	1.65 3.47 5.67 2.02	23.88 3.39 11.04 .23	.38 1.46 4.80 .29	59.92 86.50 65.76 96.64	1.36 3.02 1.70 .33	2.16 $11.03$ $.49$	100.00 100.00 100.00
I. Professional	1.65 3.47 5.67 2.02 3.98 29.47	23.88 3.39 11.04 .23 9.81 14.21	.38 1.46 4.80 .29 .61 48.94	59.92 86.50 65.76 96.64 82.92 6.88	1.36 3.02 1.70 .33 1.84 .03	2.16 11.03 .49 .84 .47 100.00	100.00 100.00 100.00 100.00 100.00 100.00
I. Professional II. Domestic III. Commercial IV. Transport & Communication V. Industrial VI. Primary Producers VII. Independent ALL CLASSES	1.65 3.47 5.67 2.02 3.98 29.47 	23.88 3.39 11.04 .23 9.81 14.21	.38 1.46 4.80 .29 .61 48.94 	59.92 86.50 65.76 96.64 82.92 6.88	1.36 3.02 1.70 .33 1.84 .03 	2.16 11.03 .49 .84 .47 100.00 100.00	100.00 100.00 100.00 100.00 100.00 100.00 100.00
I. Professional II. Domestic III. Commercial IV. Transport & Communication V. Industrial VI. Primary Producers VII. Independent ALL CLASSES  PRO  I. Professional II. Domestic	1.65 3.47 5.67 2.02 3.98 29.47       PORTION	23.88 3.39 11.04 23 9.81 14.21  1.71 PER CEI	.38 1.46 4.80 .29 .61 48.9466	59.92 86.50 65.76 96.64 82.92 6.88  13.77 LL CLASS	1.36 3.02 1.70 .33 1.84 .03   .39	2.16 11.03 .49 .84 .47 100.00 100.00 82.60	100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00
I. Professional II. Domestic III. Commercial IV. Transport & Communication V. Industrial VI. Primary Producers VII. Independent ALL CLASSES  PRO  I. Professional II. Domestic III. Commercial IV. Transport & Communication	1.65 3.47 5.67 2.02 3.98 29.47       	23.88 3.39 11.04 23 9.81 14.21  1.71 PER CEI	.38 1.46 4.80 .29 .61 48.94  .66	59.92 86.50 65.76 96.64 82.92 6.88  13.77	1.36 3.02 1.70 .33 1.84 .03   .39	2.16 11.03 .49 .84 .47 100.00 100.00	100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 2.49 7.19 2.37 .23 5.10
I. Professional II. Domestic III. Commercial IV. Transport & Communication V. Industrial VI. Primary Producers VII. Independent ALL CLASSES  PRO  I. Professional II. Domestic III. Commercial IV. Transport & Communication	1.65 3.47 5.67 2.02 3.98 29.47	23.88 3.39 11.04 .23 9.81 14.21  1.71 PER CEN 34.64 14.19 15.26 .03 29.17	.38 1.46 4.80 .29 .61 48.94666  NT. ON Al  1.46 15.99 17.33 .10 4.75	59.92 86.50 65.76 96.64 82.92 6.88  13.77 LL CLASS	1.36 3.02 1.70 .33 1.84 .0339  ES.  8.76 56.20 10.44 .19 24.35	2.16 11.03 .49 .84 .47 100.00 100.00 82.60	100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 2.49 7.19 2.37 .23

#### Numbers in each Grade of Occupation. Commonwealth, 1911.



GRAPH No. 147.

Amongst breadwinners, in each class except that of Primary Producers, wage earners were most numerous, those assisting without wages ranking first in the case of Primary Producers. Workers on own account ranked second in the Professional, the Commercial and the Industrial Classes, while employers ranked second in the Domestic, the Transport and Communication and the Primary Producers Classes.

Graph No. 147 furnishes for each sex a representation of the number of persons in each grade of occupation in the Commonwealth as a whole. The scale on the left margin of the Graph denotes the numbers of "hundreds of thousands" of persons represented, and applies to both male and female portions. The letters shewn beneath the pillars have the significance indicated in Section 14 above.

Of the whole male population those in receipt of wages and salary represented 45.67 per cent., while of the whole female population those in receipt of salary and wages represented 13.77 per cent. Those to whom grade was not applicable represented 34.22 per cent. in the case of males, and 82.60 per cent. in the case of females.

16. Geographical Distribution of Professional Class in Grades.—A classification of the males in the Professional Class in 1911, according to grade, and also according to State or Territory of enumeration is furnished in the following table:—

#### Grade of Occupation of Males. 1911.

CLASS I. PROFESSIONAL.

				Gr	ADE OF C	CCUPATION	•		ALL
STATE OR TERRIT	ORY.		E.	О.	Α.	w.	N.	N.A.	GRADES
				NUMBE	R.	· · · · · · · · · · · · · · · · · · ·	<del>`</del>	-	·
STATES-		Ī			1	1			]
New South Wales			3,069	3,365	55	26,062	406	4,318	37,275
Victoria			2,316	2,475	26	18,061	320	4,107	27,305
Queensland			914	868	26	8,303	160	1,280	11,551
South Australia			535	540	7	4,627	38	1,057	6,804
Western Australia			521	520	5	5,011	72	686	6,815
Tasmania			301	260	8	2,376	23	481	3,449
TERRITORIES-				-		,			
Northern			2	6		56	1	8	73
Federal	• •	• •	• •	• •	• •	49	1	2	52
Commonwealth			7,658	8,034	127	64,545	1,021	11,939	93,324
			PROPO	RTION P	ER CENT	· · · · · · · · · · · · · · · · · · ·			·
STATES			1						
New South Wales	• •	• •	8.23	9.03	.15	69.92	1.09	11.58	100.00
Victoria			8.48	9.06	.10	66.15	1.17	15.04	100.00
Queensland			7.91	7.51	.23	71.88	1.39	11.08	100.00
South Australia			7.86	7.94	.10	68.00	.56	15.54	100.00
Western Australia			7.64	7.63	.07	73.53	1.06	10.07	100.00
Tasmania			8.73	7.54	.23	68.89	.67	13.94	100.00
Territories—									
Northern			2.74	8.22		76.71	1.37	10.96	100.00
Federal	• •	• •		• •	• •	94.23	1.92	3.85	100.00
Commonwealth		[	8.21	8.61	.14	69.16	1.09	12.79	100.00

Leaving the Territories out of account, the highest proportion of employers amongst the professional males was found in Tasmania (8.73 per cent.), the lowest in Western Australia (7.64 per cent.); the highest proportion on own account in Victoria (9.06 per cent.), the lowest in Queensland (7.51 per cent.); the highest proportion assisting but not receiving salary or wages in Queensland and Tasmania (.23 per cent.), the lowest in Western Australia (.07 per cent.); the highest proportion wage earning in Western Australia (73.53 per cent.), the lowest in Victoria (66.15 per cent.); the highest proportion unemployed in Queensland (1.39 per cent.), the lowest in South Australia (.56 per cent.); the highest proportion to whom grade is not applicable in South Australia (15.54 per cent.), the lowest in Western Australia (10.07 per cent.).

The succeeding table furnishes a similar classification in respect of females in the professional class at the Census of 1911:—

Grade of Occupation of Females. 1911.

CLASS I.—PROFESSIONAL.

		GRADE OF OCCUPATION.							
STATE OR TERRITORY.	E.	О.	Α.	w.	N.	N.A.	GRADES		
		NUMBE	R.						
STATES					-		1		
New South Wales	326	4,679	63	11,325	271	2,713	19,37		
Victoria	322	4,356	35	10,239	263	2,107	17,322		
Queensland	66	1,221	57	4,177	64	711	6,29		
South Australia	73	1,124	30	2,899	39	451	4,61		
Western Australia	56	877	6	1,882	50	605	3,47		
Tasmania	35	467	14	1.388	39	233	2,17		
ERRITORIES-				· ·			· ·		
Northern		2		9		<b>2</b>	13		
Federal				7		1			
Commonwealth	878	12,726	205	31,926	726	6,823	53,28		

## Grade of Occupation of Females. 1911,—continued.

CLASS I. PROFESSIONAL.

		GRADE OF OCCUPATION.						
STATE OR TERRITORY.		E,	0.	Α.	w.	N.	N.A.	ALL GRADES
	•	PROPO	RTION P	ER CENT				,
STATES—						_		
New South Wales		1.68	24.15	.32	58.45	1.40	14.00	100.00
Victoria	• •	1.86	25.15	.20	59.11	1.52	12.16	100.00
Queensland		1.05	19.39	.91	66.34	1.02	11.29	100.00
South Australia		1.58	24.35	.65	62.80	.85	9.77	100.00
Western Australia		1.61	25.23	.17	54.14	1.44	17.41	100.00
Tasmania:		1.61	21.46	.64	63.79	1.79	10.71	100.00
CERRITORIES—								
Northern		• •	15.38		69.24		15.38	100.00
Federal	• •	• •	••	• •	87.50	• •	12.50	100.00
Commonwealth		1.65	23.88	.38	59.92	1.36	12.81	100.00

Leaving out of account the Territories for which the figures are unimportant, the highest and lowest percentages for the several grades were as follows:—(i.) Employers, Victoria (1.86 per cent.), Queensland (1.05 per cent.); Workers on own account, Western Australia (25.23 per cent.), Queensland (19.39 per cent.); Assisting but not receiving wages, Queensland (.91 per cent.), Western Australia (.17 per cent.); Wage earners, Queensland (66.34 per cent.), Western Australia (54.14 per cent.); Unemployed, Tasmania (1.79 per cent.), South Australia (.85 per cent.); Grade not applicable, Western Australia (17.41 per cent.), South Australia (9.77 per cent.).

17. Geographical Distribution of Domestic Class in Grades.—The next table furnishes an analysis of males in the domestic class in each of the States and Territories of the Commonwealth classified according to Grade of occupation. :—

Grade of Occupation of Males. 1911.

CLASS II.—DOMESTIC.

				GR	ADE OF O	CCUPATION.			ALL
STATE OR TERRITO	PRY.		E.	о.	Α.	w.	N.	N.A.	GRADES
				NUMBER	₹,				
STATES—		1							<u> </u>
New South Wales			3,345	1,180	226	12,826	725	773	19,075
Victoria			2,472	997	150	9,168	590	500	13,877
Queensland			1,226	484	158	4,059	288	201	6,416
South Australia			654	232	73	2,352	75	91	3,477
Western Australia			843	280	27	2,909	191	112	4,362
Tasmania			339	144	26	928	48	41	1,526
Territories—									
Northern		)	7	,11	1	103	4	1	127
Federal	• •		1	• •	• •	10	• •	• •	11
Commonwealth			8,887	3,328	661	32,355	1,921	1,719	48,871
			DDODOD'	TION PER	OENT				\$
			INOION.	IION FEF	CENI.				
STATES—			1						Ī
New South Wales	• •	• • •	17.54	6.19	1.18	67.24	3.80	4.05	100.00
Victoria	• •		17.81	7.19	1.08	66.07	4.25	3.60	100.00
Queensland			19.11	7.54	2.46	63.27	4.49	3.13	100.00
South Australia		• •	18.81	6.67	2.10	67.64	2.16	2.62	100.00
Western Australia		• •	19.32	6.42	.62	66.69	4.38	2.57	100.00
Tasmania		• •	22.21	9.44	1.70	60.81	3.15	2.69	100.00
Territories—									100.00
Northern	• •	•••	5.51	8.66	.79	81.10	3.15	.79	100.00
Federal	• •	••	9.09	••	• •	90.91	••	• •	100.00
COMMONWEALTH			18.18	6.81	1,35	66.21	3.93	3.52	100.00

Exclusive of the Territories the highest and lowest percentages for the several grades were as follows:—(i.) Employers, Tasmania (22.21 per cent.), New South Wales (17.54 per cent.); (ii.) Workers on own account, Tasmania (9.44 per cent.), New South Wales (6.19 per cent.); (iii.) Assisting but not receiving salary or wages, Queensland (2.46 per cent.), Western Australia (.62 per cent.); (iv.) Receiving salary or wages, South Australia (67.64 per cent.), Tasmania (60.81 per cent.); (v.) Unemployed, Queensland (4.49 per cent.), South Australia (2.16 per cent.); (vi.) Grade not applicable, New South Wales (4.05 per cent.), Western Australia (2.57 per cent.).

A similar analysis of the data relative to females in the Domestic Class is furnished in the succeeding table :—  $\,$ 

#### Grade of Occupation of Females. 1911.

#### CLASS II.—DOMESTIC.

	GRADE OF OCCUPATION.						
STATE OR TERRITORY.	E.	О.	Α.	w.	N.	N.A.	GRADES.

#### NUMBER.

		1,605	1,815	812	47,791	1,499	1,002	54,524
		2,076	1,722	356	41,829	1,605	1,251	48,839
		734	679	454	17,274	704	506	20,351
		360	406	385	12,742	268	178	14,339
		461	456	133	7,739	405	182	9,376
		105	135	107	5,753	. 175	212	6,487
		2			72			74
• •	• •	• •	1	1	62	• •		64
		5,343	5,214	2,248	133,262	4,656	3,331	154,054
			2,076 734 360 461 105	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

#### PROPORTION PER CENT.

STATES-								
New South Wales	 	2.94	3.33	1.49	87.65	2.75	1.84	100.00
Victoria	 	4.25	3.52	.73	85.65	3.29	2.56	100.00
$\mathbf{Queensland}$	 	3.61	3.34	2.23	84.88	3.46	2.48	100.00
South Australia	 	2.51	2.83	2.69	88.86	1.87	1.24	100.00
Western Australia	 	4.92	4.86	1.42	82.54	4.32	1.94	100.00
Tasmania	 	1.62	2.08	1.65	88.68	2.70	3.27	100.00
Territories—								
Northern	 	2.70			97.30			100.00
Federal	 		1.56	1.56	96.88	••		100.00
Commonwealth	  -	3.47	3.39	1.46	86.50	3.02	2.16	100.00

Amongst the States the highest and lowest percentages for the several grades were as follows:—(i.) Employers, Western Australia (4.92 per cent.), Tasmania (1.62 per cent.); (ii.) Workers on own account, Western Australia (4.86 per cent.), Tasmania (2.08 per cent.); (iii.) Assisting but not receiving salary or wages, South Australia (2.69 per cent.), Victoria (.73 per cent.); (iv.) Receiving salary or wages, South Australia (88.86 per cent.), Western Australia (82.54 per cent.); (v.) Unemployed, Western Australia (4.32 per cent.), South Australia (1.87 per cent.); (vi.) Grade not applicable, Tasmania (3.27 per cent.), South Australia (1.24 per cent.).

18. Geographical Distribution of Commercial Class in Grades.—In the next table is given an analysis of the data concerning the Commercial Class for the males in each State and Territory, classified according to grade of occupation:—

## Grade of Occupation of Males. 1911. CLASS III.—COMMERCIAL.

•				Gr	ADE OF	OCCUPATION			ALL
STATE OR TERRIT	ORY.	-	E.	о.	Α.	w.	N.	N.A.	GRADES
				NUMB	ER.	<u>'</u>			
STATES		1				1	1		[
New South Wales			12,196	10,363	734	58,240	1,996	5,865	89,394
Victoria			10,684	8,116	491	49,773	1,763	5,376	76,203
$\mathbf{Q}$ ueensland			3,701	2,995	386	19,821	824	1,541	29,268
South Australia		!	2,939	2,335	257	15,424	293	1,542	22,790
Western Australia			2,211	1,560	86	10,656	396	613	15,522
Tasmania			1,118	708	72	4,646	124	552	7,220
Territories—		İ							
Northern			38	35	2	119	2		196
Federal	• •	• •	3	5	• •	7	• •	4	19
Commonwealth			32,890	26,117	2,028	158,686	5,398	15,493	240,612
			PROP	ORTION I	ER CEN	T.	<u>'</u>		1
STATES-									
New South Wales	• •	• •	13.65	11.59	.82	65.15	2.23	6.56	100.00
Victoria	• •	• •	14.02	10.65	.64	65.32	2.31	7.06	100.00
Queensland	• •	• •	12.65	10.23	1.32	67.72	2.82	5.26	100.00
South Australia	• •	• •	12.90	10.24	1.13	67.68	1.28	6.77	100.00
Western Australia	• •	• •	14.25	10.05	.55	68.65	2.55	3.95	100.00
Tasmania	• •	• •	15.48	9.81	1.00	64.35	1.72	7.64	100.00
TERRITORIES— Northern			10.20	15.00	1.00	60.71	1.02		100.00
Federal	• • •	••	$19.39 \\ 15.79$	$17.86 \\ 26.32$	1.02	$\frac{60.71}{36.84}$		21.05	100.00 100.00
rederai	• •	•••	10.79	20.32	•••	30.84	••	21.00	100.00
Commonwealth			13.67	10.86	.84	65.95	2.24	6.44	100.00

Omitting the Territories the greatest and least proportions for the several grades were as follows:—(i.) Employers, Tasmania (15.48 per cent.), Queensland (12.65 per cent.); (ii.) Workers on own account, New South Wales (11.59 per cent.), Tasmania (9.81 per cent.); (iii.) Assisting but not receiving salary or wages, Queensland (1.32 per cent.), Western Australia (.55 per cent.); (iv.) Receiving salary or wages, Western Australia (68.65 per cent.), Tasmania (64.35 per cent.); (v.) Unemployed, Queensland (2.82 per cent.), South Australia (1.28 per cent.); (vi.) Grade not applicable, Tasmania (7.64 per cent.), Western Australia (3.95 per cent.).

Corresponding particulars respecting females in the Commercial Class are given in the next table :—  $\,$ 

Grade of Occupation of Females. 1911. CLASS III.—COMMERCIAL.

			G	RADE OF (	OCCUPATION	r <b>.</b>		ALL
STATE OR TERRITORY.		Е.	o.	Α.	w.	N.	N.A.	GRADE
		,	NUM	BER.	<u>'</u>		_	
STATES-					1			
New South Wales		884	1,789	894	12,212	324	2,122	18,225
Victoria	]	1.192	2,133	577	10,932	301	2,220	17,355
Queensland		237	618	391	3,952	101	434	5,733
South Australia		266	520	337	3,183	35	445	4,786
Western Australia		150	340	122	2,050	81	198	2,941
Tasmania		146	205	112	1,046	23	179	1,711
TERRITORIES—								
Northern								·
Federal	• •	• •	••	2		••	1	8
Commonwealth	2	2,875	5,605	2,435	33,375	865	5,599	50,754
-	<u> </u>	PRO	PORTION	PER CE	NT.			···
STATES-	Ι.						77.04	100.00
New South Wales	••	4.85	9.82	4.90	67.01	1.78	11.64	100.00
Victoria	• •	6.87	12.29	3.33	62.99	1.73	12.79	100.00
Queensland	• •	4.13	10.78	6.82	68.94	1.76	7.57	100.00
South Australia	• •	5.56	10.86	7.04	66.51	.73	9.30	100.00
Western Australia	••	5.10	11.56	4.15	69.71	2.75	6.73	100.00
Tasmania	••	8.53	11.98	6.55	61.13	1.35	10.46	100.00
ERRITORIES—								
Northern	• •	• •	• • •			• •	33.33	100.00
Federal	•••	• •		66.67	•••	• •	<b>33.33</b>	100.00
Commonwealth		5.67	11.04	4.80	65.76	1.70	11.03	100.00

Amongst the States the highest and lowest percentages for the several grades were as follows:—(i.) Employers, Tasmania (8.53 per cent.), Queensland (4.13 per cent.); (ii.) Workers on own account, Victoria (12.29 per cent.), New South Wales (9.82 per cent.); (iii.) Assisting but not receiving salary or wages, South Australia (7.04 per cent.), Victoria (3.33 per cent.); (iv.) Receiving salary or wages, Western Australia (69.71 per cent.), Tasmania (61.13 per cent.); (v.) Unemployed, Western Australia (2.75 per cent.), South Australia (.73 per cent.); (vi.) Grade not applicable, Victoria (12.79 per cent.), Western Australia (6.73 per cent.).

19. Geographical Distribution of Transport and Communication Class in Grades.—An analysis of the number of males in the Transport and Communication Class in each State and Territory is furnished in the following table, according to Grade of Occupation:—

#### Grade of Occupation of Males. 1911.

#### CLASS IV.—TRANSPORT AND COMMUNICATION.

	GRADE OF OCCUPATION.							
STATE OR TERRITORY.	Е.	0.	Α.	w.	N.	N.A.	GRADES.	
				<u> </u>				

#### NUMBER.

Queensland South Australia	• •		868 438 368	$1,779 \\ 524 \\ 465$	$182 \\ 42 \\ 17$	18,638 14,266 10,681	$606 \\ 230 \\ 241$	$576 \\ 222 \\ 180$	$\begin{array}{c c} 22,649 \\ 15,722 \\ 11,952 \end{array}$
Western Australia Tasmania			216	210	38	3,808	77	128	4,477
TERRITORIES— Northern			16	13		148	12	5	194
Federal	• •	• •	1	1	••	11	• •		18
COMMONWEALTE			5,563	8,223	767	132,023	3,577	3,856	154,009

#### PROPORTION PER CENT.

States—							1		
New South Wales			3.76	6.05	.54	84.73	2.43	2.49	100.00
Victoria			3.59	4.06	.42	86.26	2.45	3.22	100.00
Queensland			3.83	7.86	.80	82.29	2.68	2.54	100.00
South Australia			2.79	3.33	.27	90.74	1.46	1.41	100.00
Western Australia			3.08	3.89	.14	89.36	2.02	1. <b>51</b>	100.00
Tasmania			4.82	4.69	.85	85.06	1.72	2.86	100.00
TERRITORIES-									
Northern			8.25	6.70		76.29	6.18	2.58	100.00
Federal	• •		7.69	7.69	• •	84.62		¥	100.00
COMMONWEALTH			3.61	5.34	.50	85.73	2.32	2.50	100.00

Omitting the Territories, the highest and lowest percentages for the several grades were as follows:—(i.) Employers, Tasmania (4.82 per cent.), South Australia (2.79 per cent.); (ii.) Workers on own account, Queensland (7.86 per cent.), South Australia (3.33 per cent.); (iii.) Assisting but not receiving salary or wages, Tasmania (.85 per cent.), Western Australia (.14 per cent.); (iv.) Receiving salary or wages, South Australia (90.74 per cent.), Queensland (82.29 per cent.); (v.) Unemployed, Queensland (2.68 per cent.), South Australia (1.46 per cent.); (vi.) Grade not applicable, Victoria (3.22 per cent.), South Australia (1.41 per cent.).

Corresponding data in respect of females in the Transport and Communication Class are furnished in the succeeding table :—

## Grade of Occupation of Females. 1911.

## CLASS IV.—TRANSPORT AND COMMUNICATION.

				GF	RADE OF	Occupation			ALL
STATE OR TERRIT	ORY.	. ]	E.	0.	Α.	w.	N.	N.A.	GRADES
				NUMB	ER.				
STATES—						<u> </u>			
New South Wales	• •		40	5	7	1,536	5	4	1,597
Victoria			35	2	4	1,552	5	13	1,611
Queensland		• •	6	2	<b>2</b>	610	• • •	ļ	621
South Australia	• •	• •	11		• •	336	2	1	350
Western Australia	• •	• •	2	1	٠٠,	321	1	2	327
Tasmania	• •	• •	4	1	1	321	3	3	333
TERRITORIES—									
Northern	• •	• •	• •	• • •	• •		• •	• •	
Federal	• •	•• _		••	••	6	••	• •	6
COMMONWEALTH	• •		98	11	14	4,682	16	24	4,845
			PROPO	ORTION P	ER CEN	Т.			
STATES— New South Wales			2.51	.31	.44	96.18	.31	.25	100.00
Victoria			2.17	.12	.25	96.34	.31	.81	100.00
Queensland			.97	.32	.32	98.23		.16	100.00
South Australia			3.14		.02	96.00	.57	.29	100.00
Western Australia	• •	••	.6l	.31		98.16	.31	.61	100.00
Tasmania	• •	::	1.20	.30	.30	96.40	.90	.90	100.00
TERRITORIES—	• •	••	1.20	.50	.00	00.10	.00	.00	100.00
Northern									
Federal						100.00		••	100.00
		l.							

In this case the numbers in any group other than that of wage earners is so small that the institution of comparisons furnishes little useful result. It will be seen that in all cases, the wage earners account for upwards of 96 per cent. of the total, and in two of the States for upwards of 98 per cent.

20. Geographical Distribution of Industrial Class in Grades.—The next table furnishes particulars concerning males in the Industrial Class in each State and Territory, classified according to grade of occupation:—

Grade of Occupation of Males. 1911.

## CLASS V.—INDUSTRIAL.

4,900 3,450	O. NUME	531	W.	N. 8,072	N.A.	GRADES
3,450	6,216	531	135.968	8 072	8 038	173 795
3,450	6,216	531	135,968	8 072	8 038	173 795
3,450			135,968	8 072	8.038	173 795
3,450			135,908			
		412	109,455	8,609	6,553	143,915
4,440	2,317	389	43,976	3,752	2,579	57,453
4,025	1,629	241	36,223	1,617	1,329	45,064
2,583	1,237	63	17,869	1,380	1,156	24,288
1,422	638	96	11,446	809	594	15,005
			,			
11	21	2	82	78	14	208
3	2	3	196	8	1	213
0,834	17,496	1,737	355,215	24,325	20,264	459,87
	1,422	1,422 638 11 21 3 2	1,422 638 96 11 21 2 3 2 3	1,422     638     96     11,446       11     21     2     82       3     2     3     196	1,422     638     96     11,446     809       11     21     2     82     78       3     2     3     196     8	1,422     638     96     11,446     809     594       11     21     2     82     78     14       3     2     3     196     8     1

#### Grade of Occupation of Males, 1911,-continued.

#### CLASS V.—INDUSTRIAL.

		GRADE OF OCCUPATION.							
STATE OR TERRITORY		Е.	О.	A.	w.	N.	N.A.	ALL GRADES	
		PROI	PORTION	PER CEI	NT.				
STATES—	·							1	
New South Wales		8.58	3.58	.30	78.26	4.65	4.63	100.00	
Victoria		9.34	3.78	.29	76.06	5.98	4.55	100.00	
Queensland		7.73	4.03	.68	76.54	6.53	4.49	100.00	
South Australia		8.93	3.62	.53	80.38	3.59	2.95	100.00	
Western Australia		10.64	5.09	.26	73.57	5.68	4.76	100.00	
Tasmania		9.48	4.25	.64	76.28	5.39	3.96	100.00	
Territories—									
Northern		5.29	10.10	.96	39.42	37.50	6.73	100.00	
Federal	• •	1,41	.94	1.41	92.02	3.75	.47	100.00	
Commonwealth		8.88	3.80	.38	77.24	5.29	4.41	100.00	

Apart from the Territories the highest and lowest percentages in each grade were as follows:—(i.) Employers, Western Australia (10.64 per cent.), Queensland (7.73 per cent.),; (ii.) Workers on own account, Western Australia (5.09 per cent.), New South Wales (3.58 per cent.); (iii.) Assisting but not receiving salary or wages, Queensland (.68 per cent.), Western Australia (.26 per cent.); (iv.) Receiving salary or wages, South Australia (80.38 per cent.), Western Australia (73.57 per cent.); (v.) Unemployed, Queensland (6.53 per cent.), South Australia (3.59 per cent.); (vi.) Grade not applicable, Western Australia (4.76 per cent.), South Australia (2.95 per cent.).

Corresponding particulars in respect of females in the Industrial Class are furnished in the succeeding table :—  $\,$ 

#### Grade of Occupation of Females. 1911.

#### CLASS V.—INDUSTRIAL.

				Gr	ADE OF	OCCUPATION	٧.	-	ALL
STATE OR TERRITO	RY.		E.	О.	A.	w.·	N.	N.A.	GRADES
						<u>'</u>			'
				NUMB	ER.				
STATES—									1
New South Wales			1,619	4,152	196	29,211	614	323	36,115
Victoria			1,699	3,314	178	40,303	867	401	46,762
$\mathbf{Queensland}$			385	1,370	126	9,197	236	105	11,419
South Australia			309	1,095	127	6,692	. 89	32	8,344
Western Australia			159	438	21	3,233	124	31	4,006
Tasmania			177	341	20	1,960	86	23	2,607
Territories—						,			
Northern			1	1		1	1		4
Federal	• •	• •	• •	4	• •		• •	• •	4
Commonwealth	••		4,349	10,715	668	90,597	2,017	915	109,261
			PRO	PORTION	PER CE	ent.	,		
		•		71 01111011	11111 01				
STATES— New South Wales			4.48	11.50	.54	80.88	1.70	.90	100.00
***	• •	• •	3.63	7.09	.38	86.19	1.85	.86	100.00
	• •	• •	$\frac{3.03}{3.37}$	12.00	1.10	80.19	$\frac{1.03}{2.07}$	.92	100.00
Queensland South Australia	• •	• •	3.70	13.12	$1.10 \\ 1.52$	80.20	1.07	.39	100.00
Western Australia	• •	• •	$\frac{3.70}{3.97}$	10.93	.53	80.70	3.10	.77	100.00
-	• •	• •	$\frac{3.97}{6.79}$	13.08	.93 .77	75.18	3.30	.88	100.00
Tasmania Ferritories—	• •	• •	0.79	10.00		19.18	0.00	.00	100.00
			95.00	25.00		25.00	25.00		100.00
Northern	• •	• •	25.00		• •	1		• •	100.00
Federal	• •	• •	• •	100.00	• •	••	• •	• • •	100.00
		<del>-</del>							

Leaving the Territories out of account, the highest and lowest percentages in each grade were as follows:—(i.) Employers, Tasmania (6.79 per cent.), Queensland (3.37 per cent.); (ii.) Workers on own account, South Australia (13.12 per cent.), Victoria (7.09 per cent.); (iii.) Assisting but not receiving salary or wages, South Australia (1.52 per cent.), Victoria (.38 per cent.); (iv.) Receiving salary or wages, Victoria (86.19 per cent.), Tasmania (75.18 per cent.); (v.) Unemployed, Tasmania (3.30 per cent.), South Australia (1.07 per cent.); (vi.) Grade not applicable, Queensland (.92 per cent.), South Australia (.39 per cent.).

21. Geographical Distribution of Primary Producers Class in Grades.—In the succeeding table is furnished an analysis of the data in respect of males in the Primary Producers Class in each State and Territory, classified according to grade of occupation.

## Grade of Occupation of Males. 1911.

#### CLASS VI.—PRIMARY PRODUCERS.

		G	RADE OF (	Occupation	N.		ALL
STATE OR TERRITORY.	Е.	О.	A.	w.	N.	N.A.	GRADES.

#### NUMBER.

STATES—					-	1	1		
New South Wales			35.440	26,848	18,938	114,422	3,741	5,319	204,708
Victoria			32,834	21,319	18,671	67,853	3,004	3,954	147,635
Queensland			15,542	16,218	9,003	55,917	2,501	2,154	101,335
South Australia			12,122	6,990	6,423	22,801	664	958	49,958
Western Australia			7,208	8,422	2,299	34,080	1,367	686	54,062
Tasmania			5,081	4,782	3,676	17,351	411	414	31,715
Territories—						·			
Northern			82	602	13	913	62	19	1,691
Federal		• •	72	48	28	244	5	4	401
Commonwealth	٠		108,381	85,229	59,051	313,581	11,755	13,508	591,505

## PROPORTION PER CENT.

STATES		1							
New South Wales			17.31	13.12	9.25	55.89	1.83	2.60	100.00
Victoria			22.24	14.44	12.65	45.96	2.03	2.68	100.00
Queensland			15.34	16.00	8.88	55.18	2.47	2.13	100.00
South Australia			24.26	13.99	12.86	45.64	1.33	1.92	100.00
Western Australia			13.33	15.58	4.25	63.04	2.53	1.27	100.00
Tasmania			16.02	15.08	11.59	54.71	1.30	1.30	100.00
Cerritories—									
Northern			4.85	35.60	.77	53.99	3.67	1.12	100.00
Federal	• •	• •	17.95	11.97	6.98	60.85	1.25	1.00	100.00
Commonwealth			18.32	14.41	9.98	53.02	1.99	2.28	100.00

Apart from the Territories, the highest and lowest percentages for each grade were as follows:—(i.) Employers, South Australia (24.26 per cent.), Western Australia (13.33 per cent.); (ii.) Workers on own account, Queensland (16.00 per cent.), New South Wales (13.12 per cent.); (iii.) Assisting, but not receiving salary or wages, South Australia (12.86 per cent.), Western Australia (4.25 per cent.); (iv.) Receiving salary or wages, Western Australia (63.04 per cent.), South Australia (45.64 per cent.); (v.) Unemployed, Western Australia (2.53 per cent.), Tasmania (1.30 per cent.); (vi.) Grade not applicable, Victoria (2.68 per cent.), Western Australia (1.27 per cent.).

The corresponding particulars in respect of female primary producers is furnished in the next table :—

Grade of Occupation of Females. 1911.

CLASS VI.—PRIMARY PRODUCERS.

	STATE OR TERRITORY.				RADE OF C	CCUPATION.	•		ALL
STATE OR TERRITO	ORY.		Е.	0.	Α.	w.	N.	N.A.	GRADES
				NUMI	BER.				
STATES—								· -	1
New South Wales			1,346	687	2,988	261		15	5,297
Victoria			2,469	1,028	1,943	276	3	46	5,765
Queensland			431	345	2,460	189	1	8	3,434
South Australia			505	208	648	178		10	1,549
Western Australia			176	91	279	30	1	1	578
Tasmania			175	100	157	247			679
TERRITORIES									
Northern			1			11			12
Federal	• •	• •	. 7	• 4	11	1	••	1	24
Commonwealth			5,110	2,463	8,486	1,193	5	81	17,338
		·	PR	OPORTIO	N PER C	ENT.			
STATES						1			
New South Wales			25.41	12.97	56.41	4.93		.28	100.00
Victoria			42.83	17.83	33.70	4.79	.05	.80	100.00
$\mathbf{Queensland}$			$^{\circ}12.55$	10.05	71.64	5.50	.03	.23	100.00
South Australia			32.60	13.43	41.83	11.49		.65	100.00
Western Australia			30.45	15.75	48.27	5.19	.17	.17	100.00
Tasmania			25.77	14.73	23.12	36.38			100.00
ERRITORIES—									
Northern			8.33			91.67			100.00
Federal	• •	••	29.16	16.67	45.83	4.17	••	4.17	100.00
Commonwealth			29.47	14.21	48.94	6.88	.03	.47	100.00

The female group in the Primary Producers Class is relatively unimportant, and consists very largely of female proprietors of farms, etc., and of females assisting without receiving wages in connexion with dairying and other primary pursuits. It will be seen that for the Commonwealth as a whole, less than 7 per cent. of the females in the class were wage earners, while more than 29 per cent. were employers, and nearly 49 per cent. were returned as assisting but not receiving wages or salary.

22. Grades for all Occupations, according to States and Territories.—In the following table is furnished for each of the States and Territories of the Commonwealth a summary for males of all occupations (including dependents), classified according to grade:—

Grade of Occupation, Males. Commonwealth, States and Territories, 1911.

			STAT	ES.			TERRIT	TORIES.	
Grade.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.	F.	С' <b>w</b> тн.
			·	NUMBE	R.		·	-	
E	71,235	63,127	26,691	20,713	13,734	8,477	156	80	204,213
0	51,651	39,895	24,661	12,250	12,484	6,742	688	56	148,427
A	20,812	19,910	10,144	7,043	2,497	3,916	18	31	64,371
w	399,031	287,268	150,714	95,693	81,206	40,555	1,421	517	[1,056,405]
N	16,417	15,220	8,131	2,917	3,647	1,492	159	14	47,997
N.A	298,552	230,171	109,165	68,742	47,997	36,409	292	$\boldsymbol{294}$	791,622
TOTAL	857,698	655,591	329,506	207,358	161,565	97,591	2,734	992	2,313,035
			PROP	ORTION 1	PER CEN	г.			
E	8.31	9.63	8.10	9.99	8.50	8.68	5.71	8.06	8.83
0	6.02	6.08	7.48	5.91	7.73	6.91	25.16	5.65	6.42
A	2.43	3.04	3.08	3.39	1.54	4.01	.66	3.12	2.78
W	46.52	43.82	45.74	46.15	50.26	41.56	51.97	52.12	45.67
N	1.91	2.32	2.47	1.41	2.26	1.53	5.82	1.41	2.08
N.A	34.81	35.11	33.13	33.15	<b>29.7</b> 1	37.31	10.68	29.64	34.22
TOTAL	100.00	100,00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

A feature of this table, when the relatively unimportant experience of the Territories is left out of account, is the comparatively slight divergence from the Commonwealth average of the proportions per cent. shewn for any given grade under the several States. The most striking of the divergences shewn occur in the case of Western Australia, which State, owing to its rapid development in the last twenty years, is in a much less normal position than the others. In the case of this State, the grades of "workers on own account," and of "persons receiving salary or wages" each gave a higher percentage than in any other of the States, while the grades "assisting" and "not applicable" (mainly dependents), each gave a lower percentage than in any other State. Even in this case, however, the proportions for "Employers" and "unemployed" occupied a middle position amongst those for the other States. Amongst the States the highest proportion of "employers" was shewn by South Australia (9.99 per cent.), the smallest by Queensland (8.10 per cent.). In the case of "workers on own account," Western Australia with 7.73 per cent. had the highest, while South Australia with 5.91 per cent. had the lowest proportion. In the case of those "assisting but not receiving salary or wages," Tasmania with 4.01 per cent. shewed the highest, and Western Australia with 1.54 per cent. the lowest proportion. In the case of "persons receiving salary or wages," Western Australia (50.26 per cent.) shewed the highest, and Tasmania (41.56 per cent.) the lowest proportion. In the case of the unemployed," Queensland (2.47 per cent.), gave the highest, and South Australia (1.41 per cent.) gave the lowest proportion. Finally the highest proportion in the case of those to whom grade was not applicable occurred in the case of Tasmania (37.31 per cent.), the lowest in that of Western Australia (29.71 per cent.).

Corresponding particulars for the grades of females of all occupations in the several States and Territories are furnished in the next table :—

#### Grade of Occupation, Females. Commonwealth, States and Territories, 1911.

			Stati		TERRE				
GRADE.	N.S.W.	Vie.	Q'Iand.	S.A.	W.A.	Tas.	N.	F.	C'wlth.

## NUMBER.

E O A W	5,820 13,127 4,960 102,336 2,713	7,793 12,555 3,093 105,131 3,044	1,859 4,235 3,490 35,399 1,106	1,524 3,353 1,527 26,030 433	1,004 2,203 561 15,255 662	$\begin{array}{c} 642 \\ 1,249 \\ 411 \\ 10,715 \\ 326 \end{array}$	$\begin{bmatrix} 4\\3\\ \\ \\ \\ \\ 1\end{bmatrix}$	7 9 14 76	18,65 <b>3</b> 36,7 <b>3</b> 4 14,056 295,035 8,285
N.A Total	789,036	659,960	230,218	168,333	120,549	93,620	576	722	1,769,207 2,141,970

#### PROPORTION PER CENT.

E O A W N	$\begin{array}{c} .74\\ 1.66\\ .63\\ 12.97\\ .34\\ 83.66\end{array}$	1.18 1.90 .47 15.93 .46 80.06	$\begin{array}{c} .67 \\ 1.53 \\ 1.27 \\ 12.81 \\ .40 \\ 83.32 \end{array}$	.76 1.67 .76 12.94 .21 83.66	.83 1.83 .47 12.66 .55 83.66	$\begin{array}{c} .69 \\ 1.33 \\ .44 \\ 11.44 \\ .35 \\ 85.75 \end{array}$	.69 .52  16.15 .17 82.47	.97 1.25 1.94 10.52  85. <b>32</b>	.87 1.71 .66 13.77 .39 82.60
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Amongst females, Victoria exhibited a higher proportion in the case of "employers," "workers on own account," and "persons receiving salary or wages," than was the case with any other of the States. The highest proportion for those "assisting" occurred in Queensland, for the "unemployed" in Western Australia, and for those to whom "grade was not applicable" in Tasmania. On the other hand Tasmania exhibited amongst the States the lowest proportions for "workers on own account," for those "assisting," and for the "persons receiving salary or wages." The lowest proportion for "employers" occurred in the case of Queensland, for "unemployed" in the case of South Australia, and for "grade not applicable" in Victoria.

23. Grades for Males at Successive Censuses.—Unfortunately full information respecting grades is not available in all the States for the last three Censuses, Queensland being deficient in respect of 1891 and 1901, and Western Australia in respect of 1891. The numbers available for males adjusted to allow for the unspecified, are furnished in the following table:—

Grade of Occupation of Males in each State. Comparison of Numbers, 1891, 1901 and 1911.

					<u> </u>						ı
,						G	RADE OF (	OCCUPATION	ı		ALL
	7	YEAR.			E.	0.	Α.	w.	N.	N.A.	GRADE
					NEV	v south	WALES.				
1891 1901 1911		••	••		53,589 49,077 71,315	49,664 65,798 51,707	8,970 17,674 20,843	246,365 291,322 399,548	19,526 21,177 16,431	229,889 264,957 298,846	608,003 710,005 858,690
						VICTOF	RIA.				
1891 1901 1911			••		40,013 43,288 63,127	59,031 66,811 39,895	20,787 26,889 19,910	246,536 233,211 287,268	18,523 12,183 15,220	213,199 221,338 230,171	598,089 603,720 655,591
						QUEENSL	AND.				
1911			• •		26,691	24,661	10,144	150,714	8,131	109,165	329,506
					sot	TH AUST	ΓRALIA.				
1891 1901 1911		•••	••		16,475 14,369 20,869	11,186 16,082 12,938	7,372 5,536 7,061	65,0 <b>3</b> 1 79,490 97,114	2,997 3,384 3,076	63,740 65,840 69,034	166,801 184,701 210,092
					WES	STERN A	USTRALL	Λ.			
1901 1911					7,792 13,734	10,322 12,484	1,920 2,497	61,848 81,206	3,195 3,647	27,798 47,997	112,875 161,565
						TASMAN	IA.				
1891 1901 1911					5,215 6,213 8,477	8,071 9,100 6,742	4,008 4,098 3,916	29,937 36,063 40,555	1,328 1,810 1,492	29,001 32,340 <b>36,4</b> 09	77,560 89,624 97,59

The experience of the several States in respect of numbers in the several grades at successive Censuses has been far from uniform. Thus, whilst in the case of "employers," Victoria and Tasmania shewed continuous increases from Census to Census, New South Wales and South Australia shewed a diminution between 1891 and 1901, and a marked increase between 1901 and 1911. Similar variations may be noticed in other cases. In the four States for which data for the three Censuses are available, there is in evidence in each case an increase in the number of workers on own account between 1891 and 1901 and a marked decrease between 1901 and 1911.

The succeeding table shews the ratio per cent. which the numbers in each grade in each State bore to the number for all grades for that State :—

Grade of Occupation of Males in each Class. Centesimal Comparison, 1891, 1901 and 1911.

						Gr	ADE OF C	CCUPATION			ALL
		YEAR			E.	О.	Α.	w.	N.	N.A.	GRADE
					NEW	SOUTH V	VALES.				
1891 1901 1911					8.81 6.91 8.31	8.17 9.27 6.02	1.48 2.49 2.43	40.52 41.03 46.53	3.21 2.98 1.91	37.81 37.32 34.80	100.00 100.00 100.00
						VICTORI	Α.			•	
1891 1901 1911		:: ::			6.69 7.17 9.63	9.87 11.07 6.08	3.47 4.45 3.04	41.22 38.63 43.82	3.10 2.02 2.32	35.65 36.66 35.11	100.00 100.00 100.00
				'	G	QUEENSLA	AND.				
1911	• •.	••	••		8.10	7.48	3.08	45.74	2.47	33.13	100.00
			. `		sor	UTH AUST	TRALIA.				
1891 1901 1911					9.88 7.78 9.93	6.70 8.71 6.16	4.42 3.00 3.36	38.99 43.04 46.23	1.80 1.83 1.46	38.21 35.64 32.86	100.00 100.00 100.00
					WES	STERN AU	JSTRALIA	Δ.	-		
1901 1911		•••	••		6.90 8.50	9.15 7.73	1.70 1.54	54.79 50.26	2.83 2.26	24.63 29.71	100.00
				•		TASMAN	NIA.				_
1891 1901 1911					6.72 6.93 8.69	10.41 10.15 6.91	5.17 4.57 4.01	38.60 40.24 41.55	1.71 2.02 1.53	37.39 36.09 37.31	100.00 100.00 100.00

From the trend of the percentages in the above table in those States for which data are available for the last three Censuses, it is clear that there has been a general tendency amongst males for the proportions of "employers" and "wage or salary earners" to increase, and for the proportions "on own account," "assisting," "unemployed," and "not applicable" (dependent) to diminish.

<sup>24.</sup> Grades for Females at Successive Censuses.—The two succeeding tables furnish in respect of females information corresponding to that given for males in Section 23. The numbers, where available, for the last three Censuses are as follows:—

Grade of Occupation of Females in each State. Comparison of Numbers, 1891, 1901 and 1911.

		Gr	RADE OF C	CCUPATION.			ALL
YEAR.	Е.	О.	<b>A.</b>	w.	N.	N.A.	GRADES
	NE	EW SOUT	H WALES	3			·
			ik Wilde			p.	
1891 1901 1911	2,643 4,939 5,827	14,141 16,848 13,136	7,534 6,084 4,974	54,943 72,386 102,412	2,867 3,649 2,713	433,823 540,935 660,696	515,95 644,84 789,75
				<u> </u>			
	,	VICTO	RIA			·	
<u>:</u>							
1891 1901 1911	3,072 5,007 7,793	15,942 20,556 12,555	5,899 30,111 3,093	73,014 84,171 105,131	3,270 $2,731$ $3,044$	440,554 454,774 528,344	541,75 597,356 659,966
		QUEENS	LAND.				
1911	1,859	4,235	3,490	35,399	1,106	230,218	276,30
	Se	OUTH AU	STRALIA				
1891 1901 1911	1,013 1,095 1,528	1,851 3,566 3,356	1,578 2,252 1,527	18,989 23,492 26,123	419 692 434	129,780 147,359 168,808	153,63 178,45 201,77
	wı	ESTERN A	AUSTRAL	IA.			
1901	651 1,004	1,814 2,203	951 561	9,173 15,255	479 662	58,181 100,864	71,249 120,549
		TASMA	NIA.				
1891 1901 1911	323 462 642	1,421 2,434 1,249	1,935 2,071 411	8,059 10,229 10,715	418 356 326	56,951 67,299 80,277	69,10 82,85 93,62

In the four States for which information for three Censuses is available, there is in evidence a continuous increase in the numbers of "employers," of "wage and salary earners," and of those to whom grade was "not applicable" (mainly dependents). In each of these cases also the number working "on own account" increased from 1891 to 1901, and diminished from 1901 to 1911. In the "assisting" group it is evident that the classification in Victoria in 1901 differed essentially from that in the other States for the same Census, and also from that of the other Censuses for the same State. Presumably women engaged in domestic duties were in many cases in the Victorian Census of 1901 wrongly classed as "assisting," instead of under the head of "dependents."

The proportion per cent. of females in each grade at each Census is shewn in the next table for each of the States of the Commonwealth.

Grade of Occupation of Females in each Class. Centesimal Comparison, 1891, 1901 and 1911.

						$\mathbf{G}_{1}$	RADE OF (	OCCUPATION	•		ALL
	<u> </u>	YEAR:			E.	0.	Α.	w.	N.	N.A.	GRADE
					ŇEV	v south	WALES.				
1891 1901 1911	• •	•••			.51 .77 .74	2.74 2.61 1.66	1.46 .94 .63	10.65 11.22 12.97	.56 .57 .34	84.08 83.89 83.66	100.00 100.00 100.00
						VICTOR	JA.				
1891 1901 1911	••				.57 .84 1.18	2.94 3.44 1.90	1.09 5.04 .47	13.48 14.09 15.93	.60 .46 .46	81.32 76.13 80.06	100.00 100.00 100.00
						QUEENSI	AND.				
1911			••		.67	1.53	1.27	12.81	.40	83.32	100.00
					SC	OUTH AUS	STRALIA.				
1891 1901 1911					.66 .61 .76	1.20 2.00 1.66	1.03 1.26 .76	12.36 13.16 12.95	.27 .39 .21	84.48 82.58 83.66	100.00 100.00 100.00
,					WES	STERN AU	JSTRALIA	À.			
1901 1911	•••	••	•••		.91 .83	2.55 1.83	1.34	12.87 12.65	.67 .55	81.66 83.67	100.00 100.00
						TASMAN	NIA.				
1891 1901 1911	•••	• • • • • • • • • • • • • • • • • • • •	••		.47 .56 .68	2.06 2.94 1.33	2.80 2.50 .44	$\begin{array}{c c} 11.66 \\ 12.34 \\ 11.45 \end{array}$	.60 .43 .35	82.41 81.23 85.75	100.00 100.00 100.00

As in the case of males, there is in evidence amongst females a general tendency for the proportions of "employers" and of "those receiving salary or wages" to increase and for the proportions in the other grades to diminish. The increase in the proportions of females who are "receiving salary or wages" is most marked from Census to Census in the cases of the two most populous States, New South Wales and Victoria. At all three Censuses there was a higher proportion of Victorian females in receipt of wages or salary than was the case in any other of the States. In the case of those "receiving salary or wages," in South Australia and Tasmania there was an increase in the proportion between 1891 and 1901, and a decrease between 1901 and 1911.

25. Class of Occupation and Age of Males.—In the following table is given a classification of the number of males in the Commonwealth according to class of occupation and age, the ages being given in quinquennial groups throughout. The Census of 1911 was the first occasion on which such a detailed analysis according to age has been undertaken in conjunction with nature and grade of occupation at an Australian Census. At previous Censuses the occupational age classification was usually restricted to the seven groups of ages, 0-4, 5-14, 15-19, 20-24, 25-44, 45-59, and 60 and upwards.

Class of Occupation and Age. Number of Males. Commonwealth, 1911.

•			Cı	ASS OF OC	CUPATION.			ė.	
ÅGE.	I. Pro- fessional.	II. Domestic.	III. Com- mercial.	IV. Transport and Communication.	V. In- dustrial.	VI. Primary Pro- ducers.	VII. Inde- pendent.	VIII. De- pendents.	ALL CLASSES
0-4					••			268,073	268,073
<b>5</b> -9	3	. 3	11	3	19	109		230,011	230,159
10–14	1,227	847	6,913	1,909	9,664	14,221		181,563	216,344
15–19	7,990	4,417	34,652	16,731	67,034	76,340	24	21,141	228,329
20-24	12,439	5,938	34,033	23,841	68,941	82,023	126	2,361	229,702
25-29	12,494	5,782	29,496	23,139	59,049	70,591	138	574	201,263
30-34	10,605	5,540	26,485	18,984	47,773	62,284	189	416	172,276
35–39	10,061	5,238	22,704	16,174	41,332	56,814	192	388	152,903
40–44	9,527	5,018	21,402	14,835	40,102	54,290	255	419	145,848
45-49	8,932	4,564	18,736	13,994	37,781	49,289	314	366	133,976
50-54	7,174	3,779	14,844	10,535	31,341	40,464	415	307	108,859
<b>55</b> – <b>59</b>	4,673	2,635	9,596	6,302	20,849	27,661	575	250	72,541
60-64	3,149	2,018	7,094	3,546	13,893	20,644	1,111	304	51,759
6 <b>5</b> –69	2,262	1,540	5,745	2,006	9,694	15,950	3,025	269	40,491
70-74	1,373	869	4,152	1,103	6,376	10,702	4,323	357	29,255
75–79	822	468	2,868	621	3,673	6,389	3,752	358	18,951
80-84	436	151	1,415	190	1,718	2,721	1,981	251	8,863
85–89	125	55	368	77	475	805	640	106	2,651
90~94	28	6	88	15	126	161	183	34	641
95-99	4	1	9		28	36	31	7	116
l00 and over	••	2	1	4	3	11	12	2	35
TOTAL	93,324	48,871	240,612	154,009	459,871	591,505	17,286	707,557	2,313,035

With the exception of Class VIII., Dependents, each of the classes commences at zero at the younger ages, and after rising to a maximum declines regularly to zero at the oldest age. The point at which the maximum number occurs varies with the different classes. Thus the maximum for the professional class is in age-group 25-29; for the demestic, the transport and communication, the industrial and the primary producers in age-group 20-24; for the commercial in the age-group 15-19; and for the independent in the age-group 70-74. With minor fluctuations the numbers in the Dependent Class may be said to decline with age throughout.

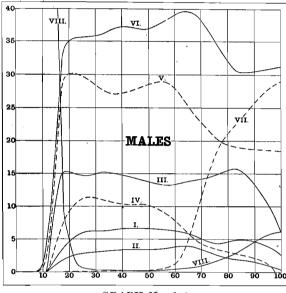
The next table furnishes for each age-group the proportion of the Commonwealth males therein who were included in each Class of Occupation:—

Class of Occupation and Age. Proportion per cent. of Males. Commonwealth, 1911.

				Cī	ASS OF OC	CUPATION.				
Age.		I. Pro- fessional.	II. Domestic.	III. Com- mercial.	IV. Transport and Communi- cation.	V. In- dustrial.	VI. Primary Pro- ducers.	VII. Inde- pendent.	VIII. De- pendents.	ALL CLASSES.
ة م						5			100.00	
0-4	• •		• • •		• • •	•••			100.00	100.00
5-9	• •	1 .5_	• • •		•••	.01	.05		99.94	100.00
10-14 15-19	• •	.57 3.50	.39 1.93	$\frac{3.20}{15.18}$	.88 7.33	$\begin{array}{c} 4.47 \\ 29.36 \end{array}$	$6.57 \\ 33.43$		83.92	100.00
20-24	• •	5.42	$\frac{1.93}{2.58}$	$15.18 \\ 14.82$	10.38	30.01	35.43   35.71		9.26	100.00
20-24 25-29	• •	6.21	$\frac{2.38}{2.87}$	14.82	11.50	$\frac{30.01}{29.34}$	35.07	.05 .07	1.03	100.00
30-34	• •	6.16	3.22	15.37	11.02	$\frac{29.34}{27.73}$	36.15	.07		100.00
30-34 35-39	• •	6.58	3.42	15.57	10.58	27.13	37.16	.13	.24	100.00
30-39 40-44	• •	6.53	3.44	14.67	10.56	$\frac{27.03}{27.50}$	37.10	.18	.25 .29	100.00
45-49	• •	6.67	3.44	13.98	10.17	28.20	36.79	.23	.29	100.00
50~54	• •	6.59	3.47	13.64	9.68	28.79	37.17	.38	.28	100.00
55-59	• •	6.44	3.63	13.23	8.69	28.74	38.13	79	.35	100.00
60-64	• •	6.08	3.90	13.71	6.85	26.84	39.88	2.15	.59	100.00
65-69		5.59	3.80	14.19	4.95	23.94	39.39	7.47	.67	
70-74	• •	4.69	$\begin{array}{c c} 3.30 \\ 2.97 \end{array}$	14.19	3.77	21.80	36.58	14.78	1.22	100.00
75-79	• •	4.34	2.47	15.13	3.28	19.38	33.71	19.80	1.89	100.00
80-84	• •	4.92	1.70	15.13 $15.97$	2.14	19.39	30.70	22.35	2.83	100.00
85-89	• •	4.72	2.07	13.88	2.90	17.92	30.37	24.14	4.00	100.00
90-94	• •	4.37	.93	13.73	2.34	19.66	25.12	28.55	5.30	100.00
95-99	• •	3.45	.86	$\frac{13.75}{7.76}$	1	24.14	31.03	26.35 $26.72$	6.04	100.00
100  and  0		0.±0	5.71	2.86	11.43	8.57	31.43	34.29	5,71	100.00
Тотаг		4.04	2.11	10.40	6.66	19.88	25.57	.75	30.59	100.00

An interesting feature of this table is the relatively small change with age exhibited by several of the classes through important ranges of ages. Thus in the professional class between the limits of 25 and 65 years of age the proportion varies from 6.08 per cent. for group 60-64, to 6.67 per cent. for group 45-49. In the domestic class between ages 30 and 70, the variation is from 3.22 per cent. for group 30-34, to 3.90 per cent. for group 60-64. In the commercial class the range for sensibly uniform proportion is very great, for between the ages of 15 and 95 the limits of variation are only from 13.23 per cent. for the group 55-59, to 15.97 per cent. for the group 80-84. In the transport and communication class the range of relatively uniform proportion is less extensive, but is well marked between ages 20 and 50, varying over this range

# Proportional Distribution of Males according to Class of Occupation and Age, Commonwealth, 1911.



GRAPH No. 148.

between the limits of 10.17 per cent. for group 40-44, and 11.50 per cent. for group 25-29. In the industrial class, between the ages of 15 and 65 the proportion varies from 26.84 per cent. in group 60-64, to 30-01 per cent. in group 20-24. In the class of primary producers the range from 15 to 80 years of age exhibits proportions varying between the limits of 33.43 per cent. for group 15-19, and 39.88 per cent. for group 60-64. The classes of independents and dependents are essentially different in their age distribution from the Thus the independent other classes. class exhibits a continuous upward trend from zero, while the dependent class after diminishing rapidly to a minimum for the age-group 30-34 increases practically continuously thereafter.

The accompanying Graph (No. 148) furnishes a representation of the proportional age distribution of Australian males according to classes of occupation. The base of each small rectangle represents 10 years of age, while the vertical

height represents 5 per cent. The Roman numerals shewn on the Graph refer to the several classes of occupation, and have the significance indicated in the preceding table.

26. Class of Occupation and Age of Females.—The next table contains a classification of the number of females in the Commonwealth according to class of occupation and age:—

Class of Occupation and Age. Number of Females. Commonwealth, 1911.

			CL	ASS OF OC	CUPATION.			•	
Age.	I. Pro- fessional.	II. Domestic.	III. Com- mercial.	IV. Transport and Communication.	V. In- dustrial.	VI. Primary Pro- ducers.	VII. Inde- pendent.	VIII. De- pendents.	ALL CLASSES
0-4								258,850	258,850
5–9 10–14	$\begin{array}{c} 14 \\ 274 \end{array}$	5,088	$\begin{array}{c} 3\\916\end{array}$	21	10	$\frac{18}{805}$	$\cdots_{2}$	$224,132 \\ 201,480$	224,200 $212,870$
1 7 10	5,955	35,820	12.450	625	4,284 $40,665$	2,931	38	124,654	223,13
15–19	11,198	36,135	11,463	943	28,491	1,686	189	129,390	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
25-29	9,323	21,369	5.960	647	12,850	1,023	232	138,265	189.66
30-34	6,613	13,502	3,626	503	6,813	949	233	128,639	160,87
35-39	5,322	10,801	2,963	472	5,036	993	222	114,658	140,46
40-44	4,248	9,069	2,645	481	3,967	1,256	297	103,499	125,46
45-49	3,397	7,817	2,444	435	2,929	1,504	380	90,336	109,24
50-54	2,641	5,678	2,032	320	1,917	1,511	448	70,789	85,33
55-59	1,754	3,821	1,538	192	1,001	1,172	469	47,343	57,29
60-64	1,189	2,490	1,392	103	602	1,114	852	36,520	44,26
65-69	752	1,423	1,217	51	402	1,001	1,495	30,359	36,70
70-74	365	609	989	33	164	709	1,689	21,618	26,17
75–79	155 57	277 80	$\frac{650}{325}$	13	86 35	$\frac{434}{167}$	1,346 778	13,648	16,60
80-84	23	35	$\frac{325}{106}$	5	6	51	329	6,293 2,169	$7,74 \\ 2,72$
00 04	4	8	29	1	2	10	93	558	70
90-94 95-99		$\begin{array}{c c} & 3 \\ \hline & 2 \end{array}$	5	• •	ĺ	4	17	98	12
00 and over	•••	1	1	• •			7	20	2
TOTAL	53,284	154,054	50,754	4,845	109,261	17,338	9,116	1,743,318	2,141,97
		1	l		· ·		] .	1	

As in the case of males referred to in Section 25, each class except that of dependents exhibits a variation with age, rising rapidly from zero to a maximum and diminishing thereafter more slowly. In the case of the professional, the domestic and the transport and communication classes, this maximum is attained in the age-group 20-24; in the commercial, the industrial, and the primary producers classes it is reached in the group 15-19; while in the independent class it is reached in the group 70-74. The dependent class diminishes rapidly from the commencement of life to group 15-19, thence increases to group 25-29, and thereafter diminishes throughout.

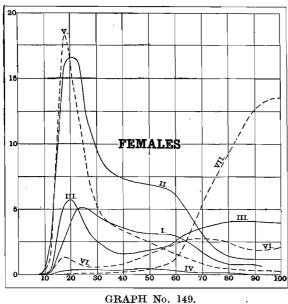
Corresponding to the numbers shewn in the preceding table, the following table furnishes the proportions for each age-group which the number in each class of occupation was of the total for the age-group:—

Ciass	OI	Occupation	and	Age.	Proportion	per	cent.	01	remaies.	Commonwealth	i, 1911.
										•	

				Cı	ASS OF OC	CUPATION.				
Age.		I. Pro- fessional.	II. Domestic.	III. Com- mercial.	IV. Transport and Communi- cation.	V. In- dustrial.	VI. Primary Pro ducers.	VII. Inde- pendent.	VIII. De- pendents.	ALL CLASSES
0-4 5-9	٠.,			. ••		• • •			100.00	100.00
5-9 10-14	• •	.0 <b>1</b> .13	$\begin{bmatrix} .01 \\ 2.39 \end{bmatrix}$				.01	••	99.97 $94.65$	100.00
15-14	• •	2.67	$\begin{vmatrix} 2.39 \\ 16.05 \end{vmatrix}$	$\frac{.43}{5.58}$	.01	$\begin{array}{c} 2.01 \\ 18.22 \end{array}$	.38 1.31	.02	94.05 55.87	100.00 100.00
20-24	• •	5.10	16.46	$\begin{array}{c} 5.38 \\ 5.22 \end{array}$	.43	12.98	.77	.02	58.95	100.00
25-29		4.92	11.27	$\frac{3.22}{3.14}$	.34	$\frac{12.98}{6.77}$	.54	.12	72.90	100.00
30-34		4.11	8.39	2.25	.31	4.24	.59	.15.	79.96	100.00
35-39		3.79	7.69	$\frac{2.20}{2.11}$	.33	3.58	.71	.16	81.63	100.00
40-44		3.39	7.23	$\frac{2.11}{2.11}$	.38	3.16	1.00	.24	82.49	100.00
45-49		3.11	7.15	$\frac{2.11}{2.24}$	.40	2.68	1.38	.35	82.69	100.00
50-54		3.09	6.65	2.38	.38	2.25	1.77	.53	82.95	100.00
55-59		3.06	6.67	2.68	.34	1.75	2.04	.82	82.64	100.00
60-64		2.69	5.63	3.14	.23	1.36	2.52	1.92	82.51	100.00
65-69		2.04	3.88	3.32	.14	1.10	2.73	4.07	82 72	100.00
70-74		1.39	2.32	3.78	.13	.63	2.71	6.45	82.59	100.00
75–79		.93	1.67	3.91	.08	.52	2.61	8.11	82.17	100.00
80-84		.74	1.03	4.20	.07	.45	2.16	10.05	81.30	100.00
8589		.85	1.29	3.90	.04	.22	1.87	12.09	79.74	100.00
90 - 94		.57	1.14	4.12		.28	1.42	13.21	79.26 .	100.00
95 - 99			1.57	3.94	i	.79	3.15	13.39	77.16	100.00
00 and or	ver		3.45	3.45	••	٠	•••	24.14	68.96	100.00
TOTAL		2.49	7.19	2.37	.23	5.10	.81	.42	81.39	100.00

The proportions amongst females exhibit much greater variation with age than is the case amongst males. The professional and domestic classes exhibit well-defined maximum points in

Proportional Distribution of Females according to Class of Occupation and Age, Commonwealth, 1911.



the age-groups 20-24, and the commercial and industrial classes in group 15-19. The transport and communication class exhibits two maximum points, one in age-group 20-24, the second in age-group 45-49. Similarly the primary producers class exhibits one well-defined maximum in group 15-19, and another in group 65-69, with a minimum between them in group 25-29. The Commercial class also attains a minimum at about 40, and a second maximum in the group 80-84. The Independent class increases with age throughout, while the dependent class fluctuates somewhat.

In Graph No. 149 a representation is furnished of the distribution per cent. of the females, at each age according to class of occupation. For convenience in representation, Class VIII. (Dependents), which at all ages amongst females accounts for more than 55 per cent. of the total, and at most ages for upwards of 75 per cent., has been omitted from the Graph. The base of each small rectangle represents 10 years of age, and the vertical height five per cent. The Roman numerals shewn on

the Graph refer to the several classes of occupation, and have the significance indicated in the preceding table.

27. Grade of Occupation and Age of Males.—A classification of the data for males in respect of grades of occupation according to age, furnishes the particulars contained in the next table:—

Grade of Occupation and Age. Number of Males. Commonwealth, 1911.

					Gi	RADE OF (	OCCUPATION	•		ALL
A	rGE'			Е.	0.	Ą.	w.	N.	N.A.	GRADES
0–4							]		268,073	268,073
<b>5</b> –9						62	86	• •	230,011	230,159
10-14	••		· · ·	3	83	7,846	26,174	483	181,755	216,344
15-19				824	2,545	28,284	167,896	5,860	22,920	228,329
20-24				9,544	9,388	14,968	182,420	8,048	5,334	229,702
25–29				19,947	14,378	6,431	150,682	6,064	3,761	201,263
30-34				26,231	16,704	2,941	117,839	4,918	3,643	172,276
3539				28,063	16,976	1,457	98,625	4,045	3,737	152,903
40-44	٠.,	• • •		29,585	18,232	795	88,759	4,052	4,425	145,848
45-49				27,597	18,228	463	79,014	3,835	4,839	133,976
50-54				22,190	16,140	260	61,343	3,642	5,284	108,859
<b>55–59</b>				14,104	11,550	177	38,692	2.690	5,328	72,541
60-64				9,974	8,880	166	23,200	2,180	7,359	51,759
65–69				7,529	7,029	183	12,887	1,544	11,319	40,491
70-74				4,575	4,600	192	5,796	490	13,602	29,255
75–79				2,656	2,548	80	2,265	132	11,270	18,951
80-84				1,065	909	53	575	14	6,247	8,863
85–89				269	206	10	132		2,034	2,651
90-94				47	28	3	17		546	641
95–99				10	3		3		100	116
100 and over	• •	• •	• •		••			• •	35	35
TOTAL				204,213	148,427	64,371	1,056,405	47,997	791,622	2,313,035

The variation with age of the numbers in the several grades is clearly brought out in this table. In each case except that in which grade is not applicable (mainly dependents), the numbers increase with age from zero to a maximum, and then regularly diminish. In the case of "employers" and of "workers on own account," the maximum is reached in the age-group 40-44; in the "assisting" grade it is reached in the group 15-19; and in the case of those earning wages or salary, and of the unemployed, in the group 20-24. The group containing those to whom grade is not applicable diminishes with age from the earliest age to group 30-34, then increases to a maximum point in the group 70-74, diminishing thereafter. It may be noted that out of the total of 64,371 in the "assisting" class, no fewer than 51,160 or nearly 80 per cent. were under the age of 25.

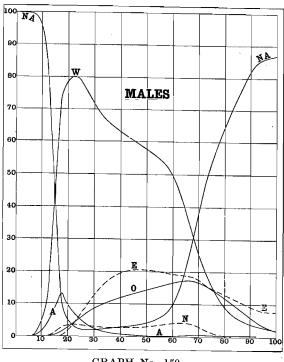
The proportions for each age-group which the number of males in each grade bore to the total for the age-group is shewn in the succeeding table :—

Grade of Occupation. Proportion per cent. of Males in each Age-group. Commonwealth, 1911.

			,	G	RADE OF (	Occupation	٧.		Atr
A	GE,	_	E	0.	Α.	w.	N.	N.A.	GRADES
0-4		 						100.00	100.00
5-9		 			.03	.04		99.93	100.00
10-14		 		.04	3.63	12.10	.22	84.01	100.00
15-19		 	.36	1,11	12.39	73.53	2.57	10.04	100.00
20-24		 	4.15	4.09	6.52	79.42	3.50	2.32	100.00
25–29		 	9.91	7.14	3.20	74.87	3.01	1.87	100.00
30-34		 	15.23	9.70	1.71	68.40	2.85	2.11	100.00
35–39		 	18.35	11.10	.95	64.50	2.65	2.45	100.00
40-44		 	20.28	12.50	.55	60.86	2.78	3.03	100.00
45-49		 	20.60	13.60	.35	58.98	2.86	3.61	100.00
50-54		 	20.38	14.83	.24	56.35	3.35	4.85	100.00
55-59		 	19.44	15.92	.24	53.34	3.71	7.35	100.00
6064		 	19.27	17.16	.32	44.82	4.21	14.22	100.00
65-69		 	18.59	17.36	.45	31.83	3.81	27.96	100.00
70-74		 	15.64	15.72	.66	19.81	1.67	46.50	100.00
75–79		 	14.01	13.45	.42	11.95	.70	59.47	100.00
80-84		 	12.02	10.25	.60	6.49	.16	70.48	100.00
85–89		 	10.15	7.77	.38	4.98		76.72	100.00
90-94		 	7.33	4.37	.47	2.65		85.18	100.00
95–99		 	8.62	2.59		2.59		86.20	100.00
100 and over	• •	 • •			• •	••	• •	100.00	100.00
ALL AGE	s	 	8.83	6.42	2.78	45.67	2.08	34.22	100.00

A comparison of the above table with the corresponding table given in Section 25, indicates that the proportionate distribution of grades of occupation varies much more markedly

#### Proportional Distribution of Males according to Grade of Occupation and Age, Commonwealth, 1911.



GRAPH No. 150.

with age than is the case with class of occupation. In the case of "employers," "workers on own account," "assisting" and "wage or salary earners," there is an increase to a well-defined maximum and regular decline thereafter, the maximum being attained in the case of "employers" in the age-group 45-49; in the case of "workers on own account" in group 65-69; in the case of those "assisting" in group 15-19; and in the case of "wage or salary earners" in group 20-24. The "unemployed" figures furnish two maximum prints are supplied to the action of the salary earners are supplied to the action of the salary earners are supplied to the action of the salary earners are supplied to the action of the salary earners are supplied to the action of the salary earners are supplied to the salary earners are salary earners. mum points, one in group 20-24, the other in group 60-64. The figures for those to whom grade is not applicable furnish a scale of rapidly diminishing proportions to a minimum in group 25-29, and a continuous rise thereafter.

A representation of the proportion per cent. of the males at each age who were comprised in each of the several grades of occupation is shewn in Graph No. 150. The base of each small rectangle represents 10 years of age, and the vertical height 10 per cent. The letters shewn on height 10 per cent. the Graph denote the several grades of occupation, and have the significance indicated in Section 14 of the present Chapter.

28. Grade of Occupation and Age of Females.—The succeeding table furnishes a classification of the numbers of females according to grade of occupation and age:

Grade of Occupation and Age. Number of Females. Commonwealth, 1911.

	_				Gi	RADE OF (	OCCUPATION	•		ALL
•	AGE.			E.	О.	Α.	w.	, N.	N.A.	GRADES
0-4 5-9		••		••					258,850	258,850
5–9 10–14	• •	• •	• •	• •	$egin{array}{c} 1 \\ 22 \end{array} \Big $	7	64	 144	224,134	224,206
15–19	• •	• •	• •	99	1,468	$872 \\ 3,711$	$10,235 \\ 89,493$	2,288	201,597 $126,079$	212,870
20-24	• •	• • •	• • •	765	4,207	2.358	78,602	$\substack{2,280\\2,251}$	131,312	223,138 $219,495$
25-29			- :: (	1,250	3,939	$\begin{array}{c} 2,336 \\ 1,425 \end{array}$	41,751	1,239	140,065	189,669
30-34			- ::	1,694	3,755	1,254	23,271	$\begin{array}{c} 1,235 \\ 645 \end{array}$	130,259	160,878
35-39				2,108	3,969	1,094	16,495	494	116,307	140,467
40-44				2,460	4,164	1,080	12,207	358	105,193	125,462
45-49				2,629	4,273	815	9,305	285	91,935	109,242
50-54				2,167	3,810	611	6,074	221	72,453	85,336
55–59 ···				1,581	2,616	376	3,661	152	48,904	57,290
60-64				1,365	1,971	231	2,125	105	38,465	44,262
65–69				1,088	1,363	127	1,131	81	32,910	36,700
70–74	٠.			753	683	67	412	18	24,243	26,176
75–79		• •		447	343	22	155	4	15,638	16,609
80-84	• •			178	113	6	44		7,399	7,740
85–89		• •	• •	54	34		10		2,622	2,720
90-94	• •	• •	• •	11	3		••		690	704
95–99	• •	• •		· 4		• •	••	• •	123	127
00 and over	• •	• •		• •	• •	• •	••	• •	29	29
TOTAL			[	18,653	36,734	14,056	295,035	8,285	1,769,207	2,141,970

With the exception of those to whom grade is not applicable, the numbers in each grade exhibit a variation with age consisting in a rise from zero to a maximum and regular decline thereafter. This maximum point is reached in the age-group 45-49 in the case of "employers," and "workers on own account," and in the group 15-19 in the case of the other three grades. The numbers for those to whom grade is not applicable diminish to a minimum in group 15-19, then rise to a maximum in group 25-29, and decline regularly thereafter.

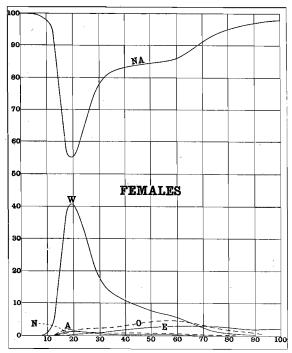
The following table furnishes for each age-group the proportion which the number of females in each grade bore to the total for the age-group :-

Grade of Occupation. Proportion per cent. of Females in each Age-group. Commonwealth, 1911.

					GRADE OF OCCUPATION.								
	A	GE.		\-	Е.	0.	Α.	w.	N.	N.A.	ALL GRADES		
0–4				Ì						100.00	100.00		
	• •	• •	• •	••	• • •	• •	. ••	.03	• •	99.97	100.00		
	• •	• •	• •	• •	• •	.01	.41	4.81	.07	94.70	100.00		
	• •	• •	. • •	• •		.66	1.66	40.11	1.03	56.50	100.00		
0- 01	• •	• •	• •	• •	.04	1.92	1.07	35.81	1.03	59.82	100.00		
	• •	• •	• •	• •	.35	2.08	.75	22.01	.65	73.85	100.00		
	• •	• •	• •	• •	.66		.78	14.47	.40	80.97	100.00		
	• •	• •	• •	• •	1.05	2.33	.78	11.74	.35	82.80	100.00		
	• •	• •	• •	• •	1.50	2.83	.86	9.73	.29	83.84	100.00		
	• •	• •	• •	• •	1.96	3.32	.74	8.52	.26	84.16	100.00		
	• •	• •	• •	• •	2.41	3.91	.72	7.12	.26	84.90	100.00		
	• •	• •	• •	• •	2.54	4.46		6.39	.26	85.36	100.00		
	• •	• •	• •	• • •	2.76	4.57	.66	4.80	.24	86.90	100.00		
	• •	• •	• •	• •	3.08	4.46	.52		.22	89.67	100.00		
	• •	• •	• •	• •	2.97	3.71	.35	3.08	.07	92.62	100.00		
	• •	• •	• •	• •	2.88	2.61	.25	1.57	.03	94.15	100.00		
		• •	• •	• • •	2.69	2.07	.13	.93		95.59	100.00		
	• •	• •	• •	• •	2.30	1.46	.08	.57	• •	96.40	100.00		
	• •	• •	• •	• •	1.98	1.25	• •	.37	• •		100.00		
	• •		• •		1.56	.43	• •	•••	• •	98.01			
	• •				3.15	• •	• •	•••	• •	96.85	100.00		
100 and	over	• •	• •	••	• •	••	• •	••	••	100.00	100.00		
ALL	AGE	s			.87	1.71	.66	13.77	.39	82.60	100.00		

In this case the maximum proportion for "employers" is in age-group 60-64; for "workers on own account" in group 55-59; for those "assisting" and for "wage or salary earners" in

Proportional Distribution of Females according to Grade of Occupation and Age, Commonwealth, 1911.



GRAPH No. 151.

group 15-19; while the "unemployed" shew equality of proportion for the groups 15-19 and 20-24. Those to whom grade is not applicable exhibit a decline to a minimum in group 15-19, and a practically continuous rise thereafter.

The accompanying Graph (No. 151) furnishes a representation of the proportion per cent. of females at each age who belonged to the several grades of occupa-The base of each small rectangle represents 10 years of age, and the vertical height 10 per cent. The letters shewn on the Graph relate to the grades of occupation involved, and have the significance indicated in Section 14 of the present Chapter.

Occupation and Conjugal Con-29. dition of Females.—In certain of the preliminary investigations made in the United Kingdom in connexion with the National Insurance scheme it was found necessary to obtain estimates of the distribution of women workers according to, conjugal condition. With a view to providing the basis for such estimates in the case of Australia, the Census material in respect of females was tabulated according

to nature and grade of occupation in conjunction with conjugal condition, the particulars in respect of the Commonwealth and separately for each State and Territory being published in Volume III. of this Report, pp. 1648 to 1679. A summary of the information for the Commonwealth as a whole is furnished in the next table in respect of classes of occupation and conjugal condition:-

Class of Occupation and Conjugal Condition of Females. Commonwealth Numbers, 1911.

	Class o	f Occupa	tion.		Never Married.	Married.	Widowed.	Divorced.	Total.
Ι.	Professional			 ·	44,163	5,185	3,803	133	53,284
II.	Domestic			 	120,034	19,646	13,698	676	154,054
III.	Commercial			 	38,018	5,846	6,776	114	50,754
IV.	Transport and	Commun	ication	 	3,070	1,175	594	6	4,845
	Industrial			 	100,385	5,257	3,408	211	109,261
VI.	Primary Produ	cers		 	7,422	4,639	5,252	25	17,338
	Independent			 	2,116	1,384	5,579	37	9,116
	Dependents			 	962,625	690,775	88,980	938	1,743,318
	Total, All	CLASSES		 	1,277,833	733,907	128,090	2,140	2,141,970

Leaving dependents out of account, the Domestic Class furnished the largest number in each conjugal condition, the Industrial Class ranking second for the "never married," and the "divorced," while the Commercial Class ranked second in the case of the "married" and the "widowed."

The proportion per cent. of the total in each class of occupation who belonged to each conjugal condition is shewn in the next table :—-

Class of Occupation and Conjugal Condition of Females. Commonwealth Proportions per cent., 1911.

Class of Occupation.	Never Married.	Married.	Widowed.	Divorced.	Total.
I. Professional	% 82.88 77.92 74.91 63.37 91.88 42.81 23.21 55.22	9,73 12,75 11,52 24,25 4,81 26,76 15,18 39,63	% 7.14 8.89 13.35 12.26 3.12 30.29 61.20 5.10	% .25 .44 .22 .12 .19 .14 .41	9/00.00 100.00 100.00 100.00 100.00 100.00 100.00
TOTAL, ALL CLASSES	 59.66	34.26	5.98	.10	100.00

In all classes except the Independent, the "never married" predominated, and accounted for upwards of 60 per cent. in all classes except those of Primary Producers, Independent and Dependents. The "never married" ranked second in the Independent Class. "Widows" predominated in the Independent Class, and ranked second in the Commercial and the Primary Producers Classes. "Married women" ranked second in the Professional, the Domestic, the Transport and Communication, the Industrial and the Dependents Classes.

A classification of the same data according to grade of occupation and conjugal condition is furnished in the next table.

Grade of Occupation and Conjugal Condition of Females. Commonwealth Numbers, 1911.

Grade of Occupation.	Never Married.	Married.	Widowed.	Divorced.	Total.
Employer Working on own account Assisting but not receiving salary or wages Receiving salary or wages Unemployed Grade not applicable	18,428 8,591 261,780 7,167	5,316 9,323 5,325 19,706 596 693,641	7,394 8,767 135 12,825 485 98,484	135 216 5 724 37 1,023	18,653 36,734 14,056 295,035 8,285 1,769,207
TOTAL, ALL GRADES	1,277,833	733,907	128,090	2,140	2,141,970

Leaving out of account those to whom grade was not applicable, the largest number in each conjugal condition was furnished by the class "receiving salary or wages," those "working on own account" occupying second place in each instance.

The proportion per cent. of the total in each grade who belonged to each conjugal condition is shewn in the succeeding table :—

Grade of Occupation and Conjugal Condition of Females. Commonwealth Proportions per cent., 1911.

Grade of Occup	pation.		-	Never Married.	Married.	Widowed.	Divorced.	Total.
Employer  Working on own account Assisting but not receiving s Receiving salary or wages Unemployed Grade not applicable  Total, All Grades	alary or	wages		% 31.14 50.16 61.12 88.73 86.51 55.17	28.50 25.38 37.88 6.68 7.19 39.21	% 39.64 23.87 96 4.35 5.85 5.57	% .72 .59 .04 .24 .45 .05	% 100.00 100.00 100.00 100.00 100.00 100.00

<sup>&</sup>quot;Never married" females predominated in all grades except that of employers, in which they ranked second, widows predominating. In all grades except that of employers married women ranked second.

The next table furnishes for each class of occupation the number of females of each grade who were in each conjugal condition:—

·		O	CCUPATIO	NS.		<u></u>	3
Class and Grade of Co	cupation an	d Conjugal	Condition of	f Females.	Commonwea	lth Number	rs, 1911.
			GRADE OF	Occupatio	N.		
CONJUGAL CONDITION.	Em-	Working on own Account.	Assisting but not Receiving Salary or Wages.	Receiving Salary or Wages.	Un- employed.	Grade not Applic- able.	ALL GRADES
		CLASS I	-PROFESS	IONAL.			
ever Married	634	7,634	151	28,864	566	6,314	44,163
arried	152	2,839	52	1,757	94	291	5,185
Vidowed	89	2,184	2	1,253	63	212	3,803
pivorced	3	69	•••	52	3	6	133
Total, Class I	878	12,726	205	31,926	726	6,823	53,284
		CLASS	II.—DOMI	ESTIC.			
lever Married	1,016	1,038	1,255	110,310	3,888	2,527	120,034
Iarried	2,382	2,087	954	13,420	405	398	19,646
Vidowed	1,878	2,035	36	9,020	336	393	13,698
Divorced	67	54	3	512	27	13	676
Total, Class II	5,343	5,214	2,248	133,262	4,656	3,331	154,054
	<u>'</u> ,	CLASS I	п.—сомм	ERCIAL.			
Never Married	710	1,431	1,168	32,134	840	1,735	38,018
Married	970	2,219	1,239	736	12	670	5,846
Vidowed	1,180	1,917	28	470	13	3,168	6,776
Divorced	15	38	••	35	••	26	114
TOTAL, CLASS III.	2,875	5,605	2,435	33,375	865	5,599	50,754
	CLASS IV	.—TRANS	PORT AND	COMMUN	ICATION.	-	
Never Married	5	1	. 5	3,032	13	14	3,070
Married	22	4	7	1,136	2	4	1,175
Widowed	71	6	2	508	1	6	594
Divorced	••	••	••	6	••	••	_  .
TOTAL, CLASS IV.	98	11	14	4,682	16	24	4,845
		CLASS	v.—INDUS	TRIAL.		•	
Never Married	2,796	8,005	509	86,518	1,856	701	100,385
Married	901	1,574	150	2,437	82	113	5,257
Widowed	616	1,091	8	1,523	72	98	3,408
Divorced	36	45	1	119	7	3	211
TOTAL, CLASS V	4,349	10,715	668	90,597	2,017	915	109,261
	CL	ASS VI.—P	PRIMARY	PRODUCE	RS.		
Never Married	647	319	5,503	922	4	27	7,422
Married	889	600	2,923	220	.1	6	4,639
Widowed	3,560	1,534	59	51		48	5,252
· · ·			1		1		

,	ployers.	on own Account.	Receiving Salary or Wages.	Salary or Wages.	employed.	Applic-	
		CLASS I	-PROFESS	IONAL.			
Never Married	634	7,634	151	28,864	566	6,314	44,163
Married	152	2,839	52	1,757	94	291	5,185
Widowed	89	2,184	2	1,253	63	212	3,803
Divorced	3	69		52	3	6	133
TOTAL, CLASS I	878	12,726	205	31,926	726	6,823	53,284
		CLASS	II.—DOME	STIC.		1	1
Never Married	1,016	1,038	1,255	110,310	3,888	2,527	120,034
Married	2,382	2,087	954	13,420	405	398	19,646
Widowed	1,878	2,035	36	9,020	336	393	13,698
Divorced	67	54	3	512	27	13	676
Total, Class II	5,343	5,214	2,248	133,262	4,656	3,331	154,054
		CLASS II	   ICOMME	ERCIAL.	<u> </u>		1
NT Nr 1		<del>.</del>				1 -0-	00.010
Never Married	710	1,431	1,168	32,134	. 840	1,735	38,018
Married Widowed	970	2,219	1,239	736	12	670	5,846
D' 1	$1,180 \\ 15$	1,917 38	28	470 35	13	$3,168 \\ 26$	6,776
			•••	<del></del>			_
Total, Class III.	2,875	5,605	2,435	33,375	865	5,599	50,754
	CLASS IV	TRANS	PORT AND	COMMUN	ICATION.	1	1
Never Married	5	1	. 5	3,032	13	14	3,070
Married	22	4	7	1,136	. 2	4	1,175
Widowed	71	6	2	508	1	6	594
Divorced	•••	••	••	6		••	6
TOTAL, CLASS IV.	98	11	14	4,682	16	24	4,845
		CLASS	v.—indus	TRIAL.	·	•	
Never Married	2,796	8,005	509	86,518	1,856	701	100,385
Married	901	1,574	150	2,437	82	113	5,257
Widowed	616	1,091	8	1,523	72	98	3,408
Divorced	36	45	1	119	7	3	211
TOTAL, CLASS V	4,349	10,715	668	90,597	2,017	915	109,261
	CL.	ASS VI.—P	RIMARY	PRODUCE	RS.	-	
Never Married	647	319	5,503	922	4	27	7,422
Married	889	600	2,923	220	. 1	6	4,639
Divorced	$\substack{3,560\\14}$	1,534 10	59 1	51	• • • • • • • • • • • • • • • • • • • •	48	5,252 25
TOTAL, CLASS VI.	5,110	2,463	8,486	1,193	5	81	17,338
		CLASS VI	 I.—INDEPE	NDENT		!	
	_		1	<u> </u>			<del></del>
				1	1	2,116	2,116
M 1			• •	•••	• •		
Married	••				••	1,384	1,384
Married Widowed	••			••	•••	1,384 5,579	1,384 5,579
Married Widowed Divorced	••				••	1,384	1,384 5,579 37
Married Widowed	••	•••		••	•••	1,384 5,579	1,384 5,579
Married Widowed Divorced	••			•••		1,384 5,579 37	1,384 5,579 37
Married Widowed Divorced  TOTAL, CLASS VII.	••			•••		1,384 5,579 37	1,384 5,579 37 9,116
Married	••	CLASS VI	         	NDENTS.		1,384 5,579 37 9,116	1,384 5,579 37 9,116
Married Widowed Divorced  TOTAL, CLASS VII.  Never Married Married Widowed		CLASS VI	     	NDENTS.		1,384 5,579 37 9,116 962,625 690,775 88,980	1,384 5,579 37 9,116 962,625 690,775 88,980
Married		CLASS VI	  п.— <b>DE</b> РЕТ	NDENTS.		1,384 5,579 37 9,116	1,384 5,579 37 9,116 962,625 690,775
Married Widowed Divorced  Total, Class VII.  Never Married Married Widowed		CLASS VI	  U.—DEPEI	NDENTS.		1,384 5,579 37 9,116 962,625 690,775 88,980	1,384 5,579 37 9,116 962,625 690,775 88,980

.

The proportion per cent. of the total of each grade in each class who belonged to each conjugal condition is shewn in the following table:—  $\,$ 

Class and Grade of Occupation and Conjugal Condition of Females. Commonwealth Proportions per cent. 1911

			GRADE OF	Occupation	N.		
CONJUGAL CONDITION.	Em- ployers.	Working on own Account.	Assisting but not Receiving Salary or	Receiving Salary or Wages.	Un- employed.	Grade not Applic- able.	ALL GRADES
		CT ASS T	Wages.  —PROFES	STOWAT			
		CLASS 1.	—I IVOT IZO	JONAL.	· · ·		I
Never Married	72.21	59.99	73.66	90.41	77.96	92.54	82.88
Married	1-01	22.31	25.37	5.50	12.95	4.26	9.73
Widowed	10.14	17.16	.97	3.93	8.68	3.11	7.14
Divorced	.34	.54	• •	.16	.41	.09	.25
TOTAL, CLASS I	100.00	100.00	100,00	100.00	100.00	100.00	100.00
·	<u> </u>						
<u> </u>	1	CLASS	II.—DOME	STIC.	1 1		1
Never Married	19.02	19.91	55.83	82.78	83.50	75.86	77.92
Married	44.58	40.03	42.44	10.07	8.70	11.95	12.75
Widowed		39.03	1.60	6.77	7.22	11.80	8.89
Divorced	1.25	1.03	.13	.38	.58	.39	.44
TOTAL, CLASS II	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	_!	CLASS I	II.—COMMI	ERCIAL.			
Torror Married	94.50	1			05.11		
Never Married Married	$24.70 \\ 33.74$	25.53 39.59	47.97 50.88	$96.28 \\ 2.21$	97.11 1.39	$30.99 \\ 11.97$	74.91 11.52
Widowed	41.04	34.20	1.15	1.41	1.50	56.58	13.35
Divorced	.52	.68		.10		.46	.22
TOTAL, CLASS III.	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	CLASS IV	/.—TRANS	PORT AND	COMMUN	ICATION.		
Never Married	5.10	0.00	95.51		01.05	FO.88	20.07
Never Married Married	22.45	9.09 36.36	35.71 50.00	$\begin{array}{c c} 64.76 \\ 24.26 \end{array}$	$\begin{array}{c} 81.25 \\ 12.50 \end{array}$	$\begin{array}{c} 58.33 \\ 16.67 \end{array}$	$\begin{array}{ c c c c c } & 63.37 \\ & 24.25 \end{array}$
Widowed	72.45	54.55	14.29	10.85	6.25	25.00	12.26
Divorced				.13			.12
TOTAL, CLASS IV.	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		CLASS	 V.—INDUS	TRIAL.			
Never Married	64.29	74.71	70.00	05.50	92.02	76.61	01.00
Never Married Married		14.69	$76.20 \\ 22.45$	$95.50 \\ 2.69$	4.06	12.35	91.88 4.81
Widowed	14.10	10.18	1.20	1.68	3.57	10.71	3.12
Divorced	.83	.42	.15	.13	.35	.33	.19
TOTAL, CLASS V	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	· Cr.	ASS VIE	RIMARY I	PDANITARE 	<u> </u>		
T 15			I IIIIAIVI I				1
Never Married Married	1	12.95	64.85	77.28	80.00	33.33	42.81
$Widowed \dots \dots$	$\begin{array}{c} 17.40 \\ 69.67 \end{array}$	$24.36 \\ 62.28$	34.44	18.44 4.28	20.00	$\begin{array}{c} \textbf{7.41} \\ \textbf{59.26} \end{array}$	$26.76 \\ 30.29$
Divorced	.27	.41	.01	4.20			14
TOTAL, CLASS VI.	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		CLASS VI	I.—INDEPI	ENDENT.	1		1
Never Married		Ī			1	23.21	23.21
Married			::			15.18	15.18
Widowed						61.20	61.20
Divorced	••	••	7.	••	•••	.41.	.4]
Total, Class VII.	••	• •	• •			100.00	100.00
		CLASS VII	I—DEPE	NDENTS.	,		
Never Married	,.					55.22	55,22
Married						39.63	39.63
Widowed						5.10	5.10
${ m Divorced} \qquad \dots \qquad \dots$	••	••	• •			.05	.05
TOTAL, CLASS VIII.						100.00	100.00

30. Occupations of Metropolitan Population.—(i.) General.—The distribution of the occupations of a community in the urban and rural sections thereof is an item of considerable importance in the study of the social make-up of the population. In the case of the Australian results, those relating to the six capital cities and their suburbs may be regarded as furnishing a representation of the purely urban portion of the population, while the balance of the population, although not exclusively rural, contains so large a rural element that in the absence of a detailed analysis into urban and rural, the division available, viz., into metropolitan and extra-metropolitan, will serve many of the purposes that would be served by the more detailed classification. Particulars in respect of the several metropolitan centres for occupations classified according to the sex, age and grade of occupation of the population are given in Volume III. of this report, pp. 1680 to 1715.

(ii.) Metropolitan Males in Classes of Occupation.—A summary of the data for males in respect of classes of occupation is furnished in the succeeding table for the metropolitan centres of each of the six states:—

Class of Occupation.	Sydney. and Suburbs.	Melb. and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan.
I. Professional	18,683	16,009	4,110	4,497	3,815	1,314	48,428
II. Domestic	9,146	7,998	1,541	2,036	1,841	482	23,044
III. Commercial	52,303	48,301	11,709	15,717	8,752	2,668	139,450
IV. Transport & Communication	30,174	22,188	6,710	7,894	4,710	1,506	73,182
V. Industrial	92,796	89,681	18,665	26,741	13,094	4,900	245,877
VI. Primary Producers	9,400	9,424	3,260	5,414	2,854	1,355	31,707
VII. Independent	2,484	2,669	507	571	316	166	6,713
VIII. Dependents	90,742	81,686	21,126	27,708	17,849	6,096	245,207
ALL CLASSES	305,728	277,956	67,628	90,578	53,231	18,487	813,608

Occupations of Metropolitan Males. 1911.

The next table shews for each metropolitan centre the proportion per cent. of its male population in each class of occupation:—

Class of Occupation.	Sydney. and Suburbs.	Melb. and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan.
I. Professional	% 6.11	% 5.76	% 6.08	% 4.96	$\frac{\%}{7.17}$	% 7.11	% 5.95
II. Domestic	2.99	2.88	2.28	2.25	3.46	2.61	2.83
III. Commercial	17.11	17.38	17.31	17.35	16.44	14.43	17.14
IV. Transport & Communication	9.87	7.98	9.92	8.72	8.85	8.15	8.99
V. Industrial	30.35	32.26	27.60	29.52	24.60	26.50	30.22
VI. Primary Producers	3.08	3.39	4.82	5.98	5.36	7.33	3.90
VII. Independent	.81	.96	.75	.63	.59	.90	.83
VIII. Dependents	29.68	29.39	31.24	30.59	33.53	32.97	30.14
ALL CLASSES	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Proportion of Metropolitan Males in each Class of Occupation. 1911.

The highest and lowest percentages in the several classes were furnished as follows:—
I. Professional, Perth (7.17 per cent.), Adelaide (4.96 per cent.); II. Domestic, Perth (3.46 per cent.), Adelaide (2.25 per cent.); III. Commercial, Melbourne (17.38 per cent.), Hobart (14.43 per cent.); IV. Transport and Communication, Brisbane (9.92 per cent.), Melbourne (7.98 per cent.); V. Industrial, Melbourne (32.26 per cent.), Perth (24.60 per cent.); VI. Primary Producers, Hobart (7.33 per cent.), Sydney (3.08 per cent.); VII. Independent, Melbourne (.96 per cent.), Perth (.59 per cent.); VIII. Dependents, Perth (33.53 per cent.), Melbourne (29.39 per cent.). Leaving dependents out of account the Industrial Class predominated amongst the males of each metropolis, and in the cases of Sydney and Melbourne were even more numerous than the Dependents. In each case also the Commercial Class ranked next numerically to the Industrial, and was immediately succeeded by the Transport and Communication Class.

The next table shews the proportion which the metropolitan males in each class of occupation were of the total number of males in the State in question belonging to that class of occupation:—

Proportion of Males in each Class Resident in Metropolis. 1911.

Class of Occupation.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	C'wlth.
	%	% 58.63	%	66.09	%	%	51.89
I. Professional	50.12		35.58		55.98	38.10	
II. Domestic	47.95	57.63	24.02	58.56	42.21	31.59	47.15
III. Commercial	58.51	63.38	40.01	68.96	56.38	36.95	57.96
IV. Transport & Communication	49.63	58.07	29.63	50.21	39.41	33.64	47.52
V. Industrial	53.42	62.32	32.49	59.34	53.91	32.66	53.47
VI. Primary Producers	4.59	6.38	3.22	10.84	5.28	4.27	5.36
VII. Independent	36.62	46.39	20.86	48.51	54.58	30.24	38.83
VIII. Dependents	34.12	40.30	21.47	44.43	40.58	18.12	34.66
All Classes	35.65	42.40	20.52	43.68	32.95	18.94	35.17

The percentages given for the Commonwealth represent the ratio per cent. of the total for each class in the six capital cities to the total for such class in the Commonwealth as a whole. A comparison of the percentages shewn in this table for any class of occupation, with the corresponding percentage shewn on the last line for "all classes," furnishes evidence of the degree to which the class of occupation in question is relatively more strongly represented in the metropolitan than in the extra metropolitan area or vice versa. Thus in all the States except Western Australia there is little difference between the metroplitan proportion of dependents, and that of all classes, nor, except in the cases of Western Australia and Tasmania, is there a marked difference between the metropolitan proportion of independent class and that of all classes. In all the States the Professional, the Domestic, the Commercial, the Transport and Communication, the Industrial and the Independent Classes were relatively more numerous in the metropolitan than in the extra metropolitan areas, as was also the case with Dependents in Queensland, South Australia and Western Australia. Naturally in all the States the proportion of the Primary Producers resident in metropolitan areas was much less than the proportion for all classes. In New South Wales, Victoria and Tasmania the proportion of dependents resident in metropolitan areas was also somewhat less than the corresponding proportions for all classes.

(iii.) Metropolitan Males in Grades of Occupation.—The following table furnishes particulars concerning the number of males in each metropolitan area who belonged to each grade of occupation:—

Occupation Grades of Metropolitan Males. 1911.

Grade of Occupation.	Sydney. and Suburbs.	Melb. and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan.
Employer  Working on own account  Assisting but not receiving salary	. 12,881	17,351 11,305	3,506 2,963	5,612 3,725	3,240 2,125	1,342 766	49,073 33,765
or wages	. 570 . 162,801 . 7,890	788 144,259 9,235 95,018	490 34,998 1,897 23,774	554 47,736 1,563 31,388	115 25,986 1,420 20,345	160 8,678 440 7,101	2,677 424,458 22,445 281,190
ALL GRADES	. 305,728	277,956	67,628	90,578	53,231	18,487	813,608

In the following table is shewn for each metropolitan centre the proportion per cent. of its male population in each grade of occupation.:—

Proportion of Metropolitan Males in each Grade. 1911.

Grade of Occupation.	Sydney. and Suburbs.	Melb. and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan
Employer	. 5.89	% 6,24	% 5.18	% 6.20	% 6.09	% 7.26	% 6.03
Wantain a on orms account	. 4.21	4.07	4.38	4.11	3.99	4.14	4.15
0 - 7770,000		.28	.73	.61	.21	.87	.33
Possitring colony on magaz	. 53.25	51.90	51.75	52.70	48.82	46.94	52.17
Unemployed	. 2.58	3.32	2.81	1.73	2.67	2.38	2.76
Grade not applicable	. 33.88	34.19	35.15	34.65	38.22	38.41	34.56
ALL GRADES	. 100.00	100.00	100.00	100.00	100.00	100.00	100.00

The highest and lowest percentages in the several grades were furnished as follows:— Employer, Hobart (7.26 per cent.), Brisbane (5.18 per cent.); Working on own account, Brisbane (4.38 per cent.), Perth (3.99 per cent.); Assisting but not receiving salary or wages, Hobart (.87 per cent.), Sydney (.19 per cent.); Receiving salary or wages, Sydney (53.25 per cent.),

OCCUPATIONS.

Hobart (46.94 per cent.); Unemployed, Melbourne (3.32 per cent.), Adelaide (1.73 per cent.) Grade not applicable, Hobart (38.41 per cent.), Sydney (33.88 per cent.). In all the metropolitan areas the grades ranked in order of numerical importance as follows:—1. Receiving salary or wages; 2. Grade not applicable; 3. Employer; 4. Working on own account; 5. Unemployed; 6. Assisting but not receiving salary or wages.

The next table shews the proportion which the metropolitan males in each grade of occupation were of the total number of males in the State in question belonging to that grade:—

Proportion per cent. of Males in each Grade Resident in Metropolis. 1911.

Grade of Occupation.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	C'wlth.
Employer  Working on own account Assisting but not receiving salary	. 24.94	27.49 28.34	% 13.14 12.01	27.09 30.41	% 23.59 17.02	% 15.83 11.36	24.03 22.75
or wages	. 2.74 . 40.80 . 48.06	3.96 $50.22$ $60.68$ $41.28$	4.83 23.22 23.33 21.78	7.87 $49.88$ $53.58$ $45.66$	$\begin{array}{c} 4.61 \\ 32.00 \\ 38.94 \\ 42.39 \end{array}$	4.09 21.40 29.49 19.50	4.16 40.18 46.76 35.52
ALL GRADES.	35.65	42.40	20.52	43.68	32.95	18.94	35.17

The percentages given in the case of the Commonwealth represent the ratio per cent. of the total for each grade in the six capital cities, to the total for such grade in the Commonwealth as a whole.

In all the States the grades (a) Employer; (b) Working on own account; (c) Assisting, were relatively less strongly represented in the metropolitan than in the corresponding extrametropolitan areas, while the reverse held good in the case of the unemployed. In the case of those receiving salary or wages the metropolitan section was relatively the stronger in all cases except Western Australia, while with regard to those to whom grade was not applicable the metropolitan section was relatively the stronger in all cases except New South Wales and Victoria.

(iv.) Metropolitan Females in Classes of Occupation.—The next table furnishes a summary of the data for females in respect of classes of occupation for each of the six metropolitan centres and for these six combined:—

Occupations	a.e	Moteonoliton	Fomolog	1011
Occupations	OI.	Metropolitan	remaies.	Tatt.

					<u> </u>		
Class of Occupation.	Sydney. and Suburbs.	Melb. and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan.
I. Professional II. Domestic	26,481 145	9,837 24,553 11,287 771 36,516 195 2,081 225,775	2,153 5,301 2,462 230 6,603 98 321 54,684	2,921 7,061 3,404 174 6,241 98 461 78,708	1,930 3,983 1,925 159 2,933 61 153 42,417	715 2,067 718 57 1,154 17 179 16,543	27,636 68,218 31,876 2,064 79,928 614 5,288 665,097
ALL CLASSES	323,775	311,015	71,852	99,068	53,561	21,450	880,721

Corresponding to the above, the succeeding table furnishes for each metropolitan area the proportion per cent. of its female population in each class of occupation.

Proportion of Metropolitan Females in each Class of Occupation. 1911.

Class of Occupation.	Sydney. and Suburbs.	Melb. and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan.
I. Professional II. Domestic III. Commercial IV. Transport & Communication V. Industrial VI. Primary Producers VII. Independent VIII. Dependents	3.11 7.80 3.73 .21 8.18 .04 .65 76.28	3.16 7.90 3.63 .25 11.74 .06 .67 72.59	3.00 7.38 3.43 .32 9.19 .13 .45 76.10	2.95 7.13 3.44 .17 6.30 .10 .46 79.45	3.60 7.44 3.59 .30 5.48 .11 .29 79.19	3.33 9.64 3.35 .27 5.38 .08 .83 77.12	% 3.14 7.74 3.62 .23 9.08 .07 .60 75.52
ALL CLASSES	100.00	100.00	100.00	100.00	100.00	100,00	100.00

The highest and lowest percentages in each class of occupation were furnished as follows:

—I. Professional, Perth (3.60 per cent.), Adelaide (2.95 per cent.); II. Domestic, Hobart (9.64 per cent.), Adelaide (7.13 per cent.); III. Commercial, Sydney (3.73 per cent.), Hobart

(3.35 per cent.); IV. Transport and Communication, Brisbane (.32 per cent.), Adelaide (.17 per cent.); V. Industrial, Melbourne (11.74 per cent.), Hobart (5.38 per cent.); VI. Primary Producers, Brisbane (.13 per cent.), Sydney (.04 per cent.); VII. Independent, Hobart (.83 per cent.), Perth (.29 per cent.); VIII. Dependents, Adelaide (79.45 per cent.), Melbourne (72.59 per cent.). In all the metropolitan areas there was naturally a very large preponderance of dependents. Leaving these out of account, the Industrial Class ranked first numerically in Sydney, Melbourne and Brisbane, the Domestic Class ranking second in each of these cases. This order was, however, reversed in Adelaide, Perth and Hobart, in which the Domestic Class ranked first and the Industrial Class second. In all cases except that of Perth, the Commercial Class ranked third, and the Professional Class fourth, if dependents are omitted from consideration. In Perth, the Commercial and Professional were practically identical in number.

The next table shews the proportion which the metropolitan females in each class of occupation were of the total number of females in the State in question belonging to that Class of occupation.

Class of Occupation.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	C'wlth.
I. Professional	52.02	% 56.79	% 34.20	63.31	% 55.52	% 32.86	% 51.87
II. Domestic	46.32	50.27	26.05	49.24	42.48	31.86	44.28
III. Commercial	66.28	65.04	42.94	71.12	65.45	41.96	62.80
IV. Transport & Communication	42.14	47.86	37.04	49.71	51.38	17.12	42.60
V. Industrial	73.32	78.09	57.82	74.80	73.22	44.27	73.15
VI. Primary Producers	2.74	3.38	2.85	6.33	10.55	2.50	3.54
VII. Independent	61.54	59.34	43.91	60.58	56.25	40.41	58.01
VIII. Dependents	37.97	43.52	24.01	47.28	42.60	20.89	, 38.15
ALL CLASSES	41.03	47.13	26.00	49.24	44.43	22.91	41.12

The percentages given for the Commonwealth represent the ratio per cent. of the total for each class in the six capital cities to the total for such class in the Commonwealth as a whole.

In New South Wales, Victoria and Queensland, Classes I., II., III., IV., V. and VII. were relatively more strongly represented in the metropolitan than in the extra-metropolitan areas, and the same is also true of the other three States, with the exception of Class II. for South Australia and Western Australia, and Class IV. for Tasmania. In all cases Classes VI. and VIII. were relatively less strongly represented in the metropolitan than in the extra-metropolitan areas.

(v.) Metropolitan Females in Grades of Occupation.—The succeeding table gives the number of females in each metropolitan area who belonged to each grade of occupation:—

Occupation Grades of Metropolitan Females. 1911.

Grade of Occupation.	Sydney. and Suburbs.	Melb. and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan.
Employer Working on own account Assisting but not receiving salary	6,466	3,147 6,543	421 1,259	647 1,917	350 1,107	214 316	7,352 17,608
or wages	. 801	619	238	284	147	60	2,149
Receiving salary or wages . Unemployed	1,736	67,093 1,986	13,888 424	15,927 285	8,427 360	3,628 119	168,900 4,910
Grade not applicable	252,262	231,627	55,622	80,008	43,170	17,113	679,802
ALL GRADES	323,775	311,015	71,852	99,068	53,561	21,450	880,721

In the next table is shewn for each metropolitan area the proportion per cent. of its female population in each grade of occupation.

Proportion of Metropolitan Females in each Grade. 1911.

Grade of Occupation.	Sydney. and Suburbs.	Melb. and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan
Employer Working on own account Assisting but not receiving salary	% .79 2.00	% 1.01 2.10	% .59 1.75	% .65 1.93	% .65 2.07	% 1.00 1.47	.83 2.00
or wages	.25 18.51 .54 77.91	.20 21.57 .64 74.48	.33 19.33 .59 77.41	.29 16.08 .29 80.76	.28 15.73 .67 80.60	$\begin{array}{c} .28 \\ 16.91 \\ .56 \\ 79.78 \end{array}$	.24 19.18 .56 77.19
ALL GRADES	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The highest and lowest percentages in the several grades were furnished as follows:—Employer, Melbourne (1.01 per cent.); Brisbane (.59 per cent.); Working on own account, Melbourne (2.10 per cent.), Hobart (1.47 per cent.); Assisting but not receiving salary or wages, Brisbane (.33 per cent.), Melbourne (.20 per cent.); Receiving salary or wages, Melbourne (21.57 per cent.), Perth (15.73 per cent.); Unemployed, Perth (.67 per cent.), Adelaide (.29 per cent.); Grade not applicable, Adelaide (80.76 per cent.), Melbourne (74.48 per cent.).

The succeeding table shews the proportion which the metropolitan females in each grade of occupation were of the total number of females in the State in question, belonging to that grade:—

Proportion per	cent	οf	Females	in	each	Grade	Regident	in	Metropolis	1911
TIODOTHOR DOL	CCTTP.	OΙ	r. cimares	ш	COCII	urauc	Tresident	111	илси орона.	TOTT.

Grade of Occupation.	N.S.W.	Vie.	Q'land.	S.A.	<b>W.A.</b>	Tas.	C'wlth.
TTY 1	. 44.21 . 49.26	% 40.38 52.11	22.65 29.73	% 42.45 57.17	34.86 50.25	% 33.33 25.30	$\begin{array}{c} \% \\ 39.41 \\ 47.93 \end{array}$
or wages	. 16.15 . 58.57 . 63.99	20.01 63.82 65.24 43.84	6.82 39.23 38.34 24.16	18.60 $61.19$ $65.82$ $47.53$	26.20 55.24 54.38 42.80	14.60 33.86 36.50 21.32	15.29 57.25 59.26 38.42
ALL GRADES	. 41.03	47.13	26.00	49.24	44.43	22.91	41.12

The percentages given for the Commonwealth represent the ratio per cent. of the total for each grade in the six capital cities, to the total for such grade in the Commonwealth as a whole. In all the States (a) Workers on own account, (b) those receiving salary or wages, and (c) the unemployed, were relatively more strongly represented in the Metropolitan than in the corresponding extra-metropolitan areas, while the reverse held good in the case of (a) those assisting but not receiving salary or wages, and (b) those to whom grade was not applicable. In the case of employers the metropolitan section was relatively the stronger in New South Wales and Tasmania, while the reverse held good in the other four States, and in the Commonwealth as a whole.

31. Occupations of Extra-Metropolitan Population.—(i.) Extra-metropolitan Males in Classes of Occupation.—The next table furnishes particulars concerning the number and proportion of males in each class of occupation in the extra-metropolitan areas of the Commonwealth:—

Occupation of Extra-metropolitan Males. 1911.

Ucct	ipation (	oi Extra	a-metrop	оптап 1	Mates.	1911.				
		EXTRA-METROPOLITAN MALE POPULATION OF-								
CLASS OF OCCUPATION.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	Metro- politan Males.	
		N	JMBER.		-	· 			·	
I. Professional	18,592 9,929 37,091 30,622 80,929 195,308 4,299 175,200 551,970	377,635	4,875 17,559 15,939 38,788 98,075 1,923 77,278 261,878	2,307 1,441 7,073 7,828 18,323 44,544 606 34,658 116,780	3,000 2,521 6,770 7,242 11,194 51,208 263 26,136 108,334	2,135 1,044 4,552 2,971 10,105 30,360 383 27,554 79,104	73 127 196 194 208 1,691 9 236 2,734	52 11 19 13 213 401 5 278	44,896 25,827 101,162 80,827 213,994 559,798 10,573 462,350 1,499,427	
I. Professional	3.37 1.80 6.72 5.55 14.66 35.38 .78 31.74	2.99 1.56 7.39 4.24 14.36 36.60 .82 32.04	% 2.84 1.86 6.71 6.09 14.81 37.45 .73 29.51 100.00	% 1.98 1.23 6.06 6.70 15.69 38.14 .52 29.68	% 2.77 2.33 6.25 6.68 10.33 47.27 .24 24.13	2.70 1.32 5.76 3.76 12.77 38.38 .48 34.83	% 2.67 4.64 7.17 7.10 7.61 61.85 .33 8.63	% 5.24 1.11 1.92 1.31 21.47 40.42 .50 28.03	2.99 1.72 6.75 5.39 14.27 37.33 .71 30.84	

The highest and lowest percentages in the several classes were, apart from the territories, furnished as follows:—I. Professional, New South Wales (3.37 per cent.), South Australia (1.98 per cent.); II. Domestic, Western Australia (2.33 per cent.), South Australia (1.23 per cent.); III. Commercial, Victoria (7.39 per cent.), Tasmania (5.76 per cent.); IV. Transport and Communication, South Australia (6.70 per cent.), Tasmania (3.76 per cent.); V. Industrial South Australia (15.69 per cent.), Western Australia (10.33 per cent.); VI. Primary Producers, Western Australia (47.27 per cent.), New South Wales (35.38 per cent.); VII. Independent, Victoria (.82 per cent.), Western Australia (.24 per cent.); VIII. Dependents, Tasmania (34.83 per cent.), Western Australia (24.13 per cent.).

In the extra-metropolitan areas of all the States, leaving dependents out of account, Primary Producers were the most numerous class, followed in each case by the Industrial Class. The Commercial Class ranked third, and the Transport and Communication Class fourth in New South Wales, Victoria, Queensland and Tasmania, while the positions of these two classes were transposed in the case of South Australia and Western Australia. Owing to the smallness of the numbers involved, the territory figures are necessarily irregular.

(ii.) Extra-metropolitan Males in Grades of Occupation.—The number and proportion of males in each grade of occupation in the extra-metropolitan areas of the Commonwealth are shewn in the following table:—

Occupation Grades of Extra-metropolitan Males. 1911.

	EXTRA-METROPOLITAN MALE POPULATION OF-								
GRADE OF OCCUPATION.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	Metro- politan Males.
		N	JMBER.						
Employer Working on own account Assisting but not receiving salary or wages Receiving salary or wages Unemployed Grade not applicable TOTAL, ALL GRADES	53,213 38,770 20,242 236,230 8,527 194,988	45,776 28,590 19,122 143,009 5,985 135,153	23,185 21,698 9,654 115,716 6,234 85,391 261,878	15,101 8,525 6,489 47,957 1,354 37,354	10,494 10,359 2,382 55,220 2,227 27,652 108,334	7,135 5,976 3,756 31,877 1,052 29,308	688 18 1,421 159 292	80 56 31 517 14 294	155,144 114,663 61,694 631,947 25,555 510,433
	PERCENT	<u> </u>	<u> </u>	ALL GR	ADES.				
Employer Working on own account Assisting but not receiving salary or wages Receiving salary or wages Unemployed Grade not applicable TOTAL, ALL GRADES	9.64 7.02 3.67 42.80 1.54 35.33	12.12 7.57 5.06 37.87 1.59 35.79	8.85 8.29 3.69 44.19 2.38 32.60	12.93 7.30 5.56 41.07 1.16 31.98	9.69 9.56 2.20 50.97 2.06 25.52	9.02 7.55 4.75 40.30 1.33 37.05	5.71 25.16 .66 51.98 5.81 10.68	% 8.06 5.65 3.12 52.12 1.41 29.64	10.35 7.65 4.11 42.15 1.70 34.04

Leaving the Territories out of account, the highest and lowest percentages in the several grades were as follows:—Employer, South Australia (12.93 per cent.), Queensland (8.85 per cent.); Working on own account, Western Australia (9.56 per cent.), New South Wales (7.02 per cent.); Assisting but not receiving salary or wages, South Australia (5.56 per cent.), Western Australia (2.20 per cent.); Receiving salary or wages, Western Australia (50.97 per cent.), Victoria (37.87 per cent.); Unemployed, Queensland (2.38 per cent.), South Australia (1.16 per cent.); Grade not applicable, Tasmania (37.05 per cent.), Western Australia (25.52 per cent.).

Leaving out of account those for whom grade was not applicable, and omitting the Territories, the grades occupy the following order in the extra-metropolitan portion of each State:—i. Receiving salary or wages; ii. Employer; iii. Working on own account; iv. Assisting but not receiving salary or wages; v. Unemployed.

(iii.) Extra-metropolitan Females in Classes of Occupation.—Particulars are furnished in the next table concerning the number and proportion of females in each class of occupation in the several extra-metropolitan areas of the Commonwealth:—

Occupations of Extra-metropolitan Females. 1911.

		EXTRA	-METROPO	LITAN FE	MALE POP	ULATION	of		Total Extra Metro-
CLASS OF OCCUPATION.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	politan Females.
		NU	MBER.						
I. Professional	9,297 29,271 6,145 924 9,634 5,152 1,308 403,530 465,261	348,945	15,050 3,271 391 4,816 3,336 410 173,038 204,455	1,695 7,278 1,382 176 2,103 1,451 300 87,747 102,132		1,461 4,420 993 276 1,453 662 264 62,641 72,170	13 74  4 12  473 576	8 64 3 6 4 24 1 612 722	25,648 85,836 18,878 2,781 29,333 16,724 3,828 1,078,221 1,261,249
I. Professional II. Domestic III. Commercial IV. Transport and Communication V. Industrial VI. Primary Producers VII. Independent VIII. Dependents TOTAL, ALL CLASSES	2.00 6.29 1.32 20 2.07 1.11 .28 86.73	% 2.14 6.96 1.74 .24 2.94 1.60 .41 83.97	% 2.03 7.36 1.60 .19 2.36 1.63 .20 84.63	% 1.66 7.13 1.35 .17 2.06 1.42 .29 85.92	%2.31 8.05 1.52 .25 1.60 .77 .18 85.32	%2.02 6.12 1.38 .38 2.01 .92 .37 86.80	2.26 12.85   	% 1.11 8.86 .42 .83 .55 3.32 .14 84.77	2,03 6,81 1,50 .22 2,33 1,32 30 85,49

Amongst the breadwinners the females belonging to the Domestic Class were the most numerous. In all the States with the exception of Western Australia and Tasmania the classes next in order were the Industrial and the Professional. The two States mentioned differed in this respect only in the transposition of the Industrial and the Professional Classes. The Commercial and the Primary Producers Classes ranked next in order in New South Wales, Victoria, Western Australia and Tasmania, and in reversed order in Queensland and South Australia.

(iv.) Extra-metropolitan Females in Grades of Occupation.—The next table furnishes particulars in respect of the number and proportion of females in each grade of occupation in the extra-metropolitan areas of the Commonwealth.

Grades of	Occupation	of Extra	-Metropolitan	Females.	1911.

	EXTRA-METROPOLITAN FEMALE POPULATION OF-									
GRADE OF OCCUPATION.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	Metro- politan Females.	
		N	JMBER.					-		
Employer Working on own account Assisting but not receiving salary or wages Receiving salary or wages Unemployed Grade not applicable	3,247 6,661 4,159 42,399 977 407,818	4,646 6,012 2,474 38,038 1,058 296,717	1,438 2,976 3,252 21,511 682 174,596	877 1,436 1,243 10,103 148 88,325	654 1,096 414 6,828 302 57,694	428 933 351 7,087 207 63,164	93 1 475	7 9 14 76	11,30 19,126 11,907 126,135 3,375 1,089,40	
TOTAL, ALL GRADES	465,261	348,945	204,455	102,132	66,988	72,170	576	722	1,261,24	
PF	RCENTA	GE ON	TOTAL,	ALL GRA	ADES.				•	
Employer Working on own account Assisting but not receiving salary or wages Receiving salary or wages Unemployed Grade not applicable	%70 1.43 .89 9.11 .21 87.66	% 1.33 1.72 .71 10.90 .31 85.03	70 1.46 1.59 10.52 .33 85.40	% .86 1.41 1.22 9.89 .14 86.48	% .98 1,64 .62 10.19 .45 86.12	% 59 1.29 .49 9.82 .29 87.52	% .69 .52  16.15 .17 82.47	% .97 1.25 1.94 10.52 85.32	.90 1.52 .94 10.00 .27 86.37	
TOTAL, ALL GRADES	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	

Amongst the breadwinners those earning salary or wages were by far the most numerous, averaging ten per cent. for the whole Commonwealth, and varying only between the limits of 9.11 per cent. (New South Wales) and 10.90 per cent. (Victoria) in the several States. Those working on their own account ranked second in all the States.

32. Metropolitan and Extra-metropolitan Comparisons.—(i.) Classes of Occupation.—The following table furnishes a comparison of the number and proportion of persons of each sex in each class of occupation for the Commonwealth as a whole:—

Occupations in Classes. Commonwealth. 1911.

METROPOLITAN.				ExT	RA-METROP	OLITAN.	COMMONWEALTH,			
CLASS OF OCCUPATION.	Males.	Females,	Total.	Males.	Females.	Total.	Males.	Females.	Total.	
			NUMI	BER.					-	
1. Professional II. Domestic III. Commercial IV. Transport & Communication V. Industrial VI. Primary Producers VII. Independent VIII. Dependents	48,428 23,044 139,450 73,182 245,877 31,707 6,713 245,207	68,218 31,876 2,064 79,928 614 5,288	76,064 91,262 171,326 75,246 325,805 32,321 12,001 910,304		85,836 18,878 2,781 29,333 16,724 3,828	70,544 111,663 120,040 83,608 243,327 576,522 14,401 1,540,571	48,871 240,612 154,009 459,871 591,505	109,261	146,608 202,925 291,366 158,854 569,132 608,848 26,402 2,450,875	

Monte Are Crisque	010.600	000 501	1 404 800	, 100 107	7 007 040	0.700.070	0.010.005		4 455 00
TOTAL ALL CLASSES	813,608	880,721	1,694,329	1,499,427	1,261,249	2,760,676	2,313,035	2,141,970	4,455,00
	PER	CENTAG	E ON TO	CAL ALL	CLASSES.				
I. Professional	% 5.95	3.14	% 4.49	2.99	2.03	% 2.56	% 4.04	2.49	3.29
II. Domestic	$\frac{2.83}{17.14}$	$\begin{array}{c} 7.74 \\ 3.62 \end{array}$	5.39 10.11	1.72 6.75	6.81 1.50	4.04 4.35	$\frac{2.11}{10.40}$	7.19 2.37	4.55 6.54
IV. Transport & Communication V. Industrial	$\frac{8.99}{30.22}$	$\begin{array}{c} \textbf{.23} \\ \textbf{9.08} \end{array}$	4.44 19.23	$5.39 \\ 14.27$	2.33	3.03 8.81	6.66 19.88	.23 5.10	3.57 12.78
VI. Primary Producers VII. Independent	3.90 .83	.07 .60	1.91 .71	37.33 .71	1.32 .30	20.88 .52	25.57 .75	.81 .42	13.67 .59
III. Dependents	30.14	75.52	53.72	30.84	85.49	55.81	30.59	81.39	55,01
TOTAL ALL CLASSES	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Amongst metropolitan breadwinners the Industrial Class was numerically the strongest, followed in succession by the Commercial, the Domestic, and the Professional. Amongst extrametropolitan breadwinners Primary Producers are naturally the most numerous, and are followed in succession by the Industrial, the Commercial, the Domestic and the Professional Classes, the relative order of these four classes being the same as in the case of the metropolitan population.

(ii.) Grades of Occupation.—In the following table is furnished for the Commonwealth as a whole a comparison of the metropolitan and extra-metropolitan sections of the populations classified according to grades of occupation:—

Commonwealth Grades of Occupation. 1911.

	MET	ROPOLITAN.		Ext	RA-METROI	POLITAN.	Сомм	ONWEALTH,	•
GRADE OF OCCUPATION.	Males.	Females. Total. Males. Females.		Total,	Males.	Females.	Total.		
			NUM	BER.					
Employer Working on own account Assisting but not receiving salary	49,073 33,765	7,352 17,608	56,425 51,373	155,140 114,662	$^{11,301}_{19,126}$	166,441 133,788	204,213 148,427	18,653 36,734	
or wages Receiving salary or wages Unemployed Grade not applicable	2,677 $424,458$ $22,445$ $281,190$	$\substack{\begin{array}{c} 2,149 \\ 168,900 \\ 4,910 \\ 679,802 \end{array}}$	4,826 593,358 27,355 960,992	$\begin{array}{c} 61,694 \\ 631,947 \\ 25,552 \\ 510,432 \end{array}$	11,907 $126,135$ $3,375$ $1,089,405$	73,601 758,082 28,927 1,599,837	64,371 1,056,405 47,997 791,622	8,285	1,351,440 56,282
TOTAL, ALL GRADES	813,608	880,721	1,694,329	1,499,427	1,261,249	2,760,676	2,313,035	2,141,970	4,455,00
	PI	ERCENTA	GE ON TO	OTAL ALI	GRADES	3.			
Employer	% 6.03 4.15	.83 2.00	3.33 3.03	10 35 7.65	.90 1.52	6.03 4.84	8.83 6.42	.87 1.71	5.00 4.16
or wages	$\begin{array}{c} .33 \\ 52.17 \\ 2.76 \\ 34.56 \end{array}$	.24 19.18 .56 77.19	$\begin{array}{c} .28 \\ 35.02 \\ 1.62 \\ 56.72 \end{array}$	$egin{array}{c} 4.11 \\ 42.15 \\ 1.70 \\ 34.04 \\ \end{array}$	.94 10.00 .27 86.37	2.67 $27.46$ $1.05$ $57.95$	2.78 $45.67$ $2.08$ $34.22$	.66 13.77 .39 82.60	1.76 $30.34$ $1.26$ $57.48$
TOTAL, ALL GRADES	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100,00

Amongst breadwinners the order in numerical importance of the three principal grades was the same for metropolitan as for extra-metropolitan population, being as follows:—(i.) Receiving salary or wages; (ii.) Employer; (iii.) Working on own account. In the metropolitan population the Unemployed ranked next with the "Assisting" last, while the reverse was the case in the Extra-metropolitan population. •

33. Unemployment.—(i.) Males in States and Classes.—Although it is true that the ranks of the unemployed are supplied from all grades of occupation, persons who have previously been employers and workers on own account being found side by side with salary and wage earners, much the larger portion of the unemployed are undoubtedly those who normally rank as salary and wage earners. For this reason it is most serviceable to compile rates of unemployment from a comparison of the persons unemployed with the total obtained by adding the salary and wage earners to the unemployed, the number so obtained being approximately the number subject to the risk of unemployment. In the following table is given the number of males so exposed to risk in each class of occupation in each State and Territory, and the corresponding number and proportion unemployed. :—

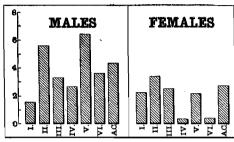
Male Unemployment in Classes. 3rd April, 1911.

			STA	TES.			TERRIT	ORIES.	C'mime
CLASS OF OCCUPATION.	N.S.W.	Vic.	Q'land.	S.A.	w.A.	Tas.	N.T.	F.T.	C'WLTH.
SALARY AN	D WAGE I	EARNER	S AND U	NEMPLO	YED CO	MBINED	•		
I. Professional II. Domestic III. Commercial IV. Transport and Communication V. Industrial VI. Primary Producers	26,468 13,551 60,236 52,990 144,040 118,163 415,448	18,381 9,758 51,536 33,892 118,064 70,857	8,463 4,347 20,645 19,244 47,728 58,418	4,665 2,427 15,717 14,496 37,840 23,465 98,610	5,083 3,100 11,052 10,922 19,249 35,447 84,853	2,399 976 4,770 3,885 12,255 17,762 42,047	57 107 121 160 160 975	50 10 7 11 204 249	65,566 34,276 164,084 135,600 379,540 325,336
		UNEM	PLOYED		l				7
I. Professional	406 725 1,996 1,477 8,072 3,741	320 590 1,763 934 8,609 3,004	160 288 824 606 3,752 2,501	38 75 293 230 1,617 664	72 191 396 241 1,380 1,367	23 48 124 77 809 411	1 4 2 12 78 62	8	1,021 1,921 5,398 3,577 24,325 11,755
TOTAL	16,417	15,220	8,131	2,917	3,647	1,492	159	14	47,997
	UN	EMPLOY	MENT B	ATE.*					
I. Professional	1.53 5.35 3.31 2.79 5.60 3.17	% 1.74 6.05 3.42 2.76 7.29 4.24 5.03	% 1.89 6.63 3.99 3.15 7.86 4.28	% 0.81 3.09 1.86 1.59 4.27 2.83	%1.42 6.16 3.58 2.21 7.17 3.86	%0.96 4.92 2.60 1.98 6.60 2.31	% 1.75 3.74 1.65 7.50 48.75 6.36	% 2.00  3.92 2.01	% 1.56 5.60 3.29 2.64 6.41 3.61

<sup>\*</sup> Percentage of number unemployed on total salary and wage earners and unemployed combined.

In all classes the rates of unemployment were higher for Queensland than for any other State, while in all classes except that of Primary Producers they were lower for South Australia than for any other State. The lowest rate for any State in the case of Primary Producers was that experienced in Tasmania. In all the States the highest rates of unemployment were those experienced in the Industrial Class, and the lowest those ascertained for the Professional Class.

Unemployment Rates in Classes of Occupation. Commonwealth, 3rd April, 1911.



GRAPH No. 152.

With  $\mathbf{but}$ slight variations amongst States the arrangement of  $\mathbf{the}$ order of unemdescending Classes  $\mathbf{in}$  a ployment rates was as follows:—(i.) Industrial; (ii.) Domestic; (iii.) Primary Producers; (iv.) Commercial; (v.) Transport and Communication; (vi.) Professional.

A representation of the rates of unemployment in each class of occupation for the Commonwealth as a whole is furnished in the accompanying Graph (No. 152). The Roman numerals at the foot of the several pillars denote the classes of occupation concerned, and have the significance indicated in the preceding table. The letters A. C. denote all classes. The rate shewn is the percentage of the

number of unemployed on the total salary and wage earners and unemployed combined. The scale on the left represents percentages, and is applicable to both the male and the female portions of the Graph.

(ii.) Females in States and Classes.—A corresponding return of the unemployment of females according to class of occupation in each State and Territory is furnished in the succeeding table:—

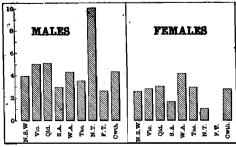
Female Unemployment in Classes. 3rd April, 1911.

Female	Unemploy	ment t	u Classe	s. oru	Apru,	1911.			
. *			St.	ATES.		,	Territ	ories.	(1)
CLASS OF OCCUPATION.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH.
SALARY AI	ND WAGE	EARNE	RS AND U	NEMPL	OYED CO	MBINED	·		, , , , , , , , , , , , , , , , , , , ,
I. Professional	11,596 49,290 12,536 1,541 29,825 261 105,049	10,502 43,434 11,233 1,557 41,170 279 108,175	190	2,938 13,010 3,218 338 6,781 178 26,463	1,932 8,144 2,131 322 3,357 31 15,917	1,427 5,928 1,069 324 2,046 247 11,041	9 72   2 11 94	$\begin{array}{c} & 762 \\ & 62 \\ & & 6 \\ & & 1 \\ \hline & 766 \end{array}$	137,918 34,240 4,698 92,614 1,198
To Collision whetever with a state of the page 18	·	UN	EMPLOY	ED.				4	
I. Professional	271 1,499 324 5 614	263 1,605 301 5 867	64 704 101  236	39 268 35 2 89	50 405 81 1 124	39 175 23 3 86	1	••	726 4,656 865 16 2,017 5
TOTAL	2,713	3,044	1,106	433	662	326	1	••	8,285
·	UNE	EMPLOY	MENT RA	ATE.*					
I. Professional	%2.34 3.04 2.58 0.32 2.06	% 2.50 3.70 2.68 0.32 2.11 1.08	% 1.51 3.92 2.49  2.50 0.53	% 1.33 2.06 1.09 0.59 1.31	2.59 4.97 3.80 0.31 3.69 3.23	2.73 2.95 2.15 0.93 4.20	%  50.00	%  	2.22 3.38 2.53 0.34 2.18 0.42
TOTAL, ALL CLASSES	2.58	2.81	3.03	1.64	4.16	2.95	1.06	••	2.73

<sup>\*</sup> Percentage of number unemployed on number of salary and wage earners and unemployed combined,

In all classes except that of Transport and Communication the unemployment rate was higher in Western Australia and lower in South Australia than in any other State. For the

Unemployment Rates in States, 3rd April, 1911.



GRAPH No. 153.

Commonwealth as a whole the arrangement of the classes in descending order of unemployment was as follows:—(i.) Domestic; (ii.) Commercial; (iii.) Professional; (iv.) Industrial; (v.) Primary Producers; (vi.) Transport and Communication.

The accompanying Graph (No. 153) furnishes a representation of rate of unemployment in each State disclosed by the Census returns. The rate shewn is the percentage of the number of unemployed on the total salary and wage earners and unemployed combined. The scale on the left represents percentages and is applicable to both the male and the female portions of the Graph.

(iii.) Duration of Unemployment of Males.—As indicated in Section 2, (p. 348), persons were treated as being unemployed if they had been out of work for more than a week prior to the Census, cases of leave of absence not being so treated. In the returns received, about 75 per cent. of those shewn as unemployed were recorded as having been out of work for periods under three months. Of the remainder the greater number fell between 3 and 7 months, but there were cases of one, two, and even three years. It appears probable that in many of these cases of long duration, it is not a question of unemployment in the ordinary acceptation of the term, but rather one of permanent incapacity. In view of this, it was decided to ignore all cases shewing durations of a year or upwards. Possibly some of the cases under twelve months which have been retained come under the same category. The number of unemployed males in each class of occupation, classified according to the duration of unemployment as at the date of the Census is given in the succeeding table:—

Unemployed Males, according to Class of Occupation and Duration of Unemployment. Commonwealth, 1911.

	Duration of Unemployment.		Class I. Pro- fessional.	Class II. Do- mestic.	Class III. Com- mercial.	Class IV. Transport and Com- munica- tion.	Class V. In-: dustrial.	Class VI. Primary Pro- ducers.	All Classes.
2 3 4 5 6 7 8 9 10 11 week 3 and 4 5 6 7 8 9	under 2 weeks  ,		94 116 85 137 28 51 15 102 1 12 4 164 59 28 69 10 9 20 8	269 311 215 286 49 89 16 183 3 11 2 236 79 82 16 11 13	548 671 532 823 153 249 97 553 36 42 9 748 251 119 329 55 58 74 38 13	559 579 461 518 112 173 47 279 17 43 6 387 117 72 121 23 20 33 4 6	3,641 3,581 2,674 3,132 694 1,864 812 2,060 93 134 34 2,622 898 411 1,088 137 148 174 82 46	1,527 2,028 1,290 1,500 288 607 171 1,045 70 67 21 1,406 510 275 630 61 90 93 48 28	6,638 7,286 5,257 6,396 1,324 3,033 1,158 4,222 220 309 76 5,563 1,914 2,319 302 407 190 103
A	LL DURATIONS	••	1,021	1,921	5,398	3,577	24,325	11,755	47,997

It will be seen that these results exhibit the usual tendency for accumulation at round numbers. Thus, the duration "4 and under 5 weeks," which necessarily includes those returned as "a month," is much higher than either "3-4 weeks" on the one hand, or "5-6 weeks" on the other. Similar accumulations are in evidence in connexion with durations of 8 weeks, 3 months and 6 months.

The ratio per cent. of the number for each duration on the total for all durations for each class of occupation is given for males in the following table:—

Distribution per cent. of Unemployed Males according to Duration of Unemployment. Commonwealth, 1911.

Duration of Unemployment.	Class I. Pro- fessional.	Class II. Do- mestic.	Class III. Com- mercial.	Class IV Transport and Com- munica- tion.	Class V. In- dustrial.	Class VI. Primary Pro- ducers.	All Classes.
	%.	%	%	%_	_%_	%	%
1 and under 2 weeks	9.21	14.00	10.15	15.63	14.97	12.99	13.83
2 ,, 3 ,,	11.36	16.19	12.43	16.19	14.72	17.25	15.18
$\overline{3}$ , 4 ,	8.33	11.19	9.86	12.89	10.99	10.97	10.95
4 , 5 ,	13.42	14.89	15.25	14.48	12.88	12.76	13.33
4 ,, 5 ,, 5 ,, 6 ,,	2.74	2.55	2.83	3.13	2.85	2.45	2.76
6 ,, 7 ,,	5.00	4.63	4.61	4.84	7.66	5.16	6.32
7 ,, 8 ,,	1.47	.83	1.80	1.31	3.34	1.45	2.41
8 ,, 9 ,,	9.99	9.53	10.25	7.80	8.47	8.89	8.80
9 ,, 10 ,,	.10	.16	.67	.48	.38	.60	.46
10 , 11 ,,	1.17	.57	.78	1.20	.55	.57	.64
11 weeks and under 3 months	.39	.10	.17	.17	.14	.18	.16
3 and under 4 months	16.06	12.29	13.86	10.82	10.78	11.96	11.59
4 ,, 5 ,,	5.78	4.11	4.65	3.27	3.69	4.34	3.99
	2.74	2.03	2.20	2.01	1.69	2.34	1.97
6 ,, 7 ,,	6.76	4.27	6.09	3.38	4.47	5.36	4.83
7 ,, 8 ,,	.98	.83	1.02	.64	.56	.52	. 63
8 ,, 9 ,,	.88	.57	1.07	.56	.61	.77	.70
9 ,, 10 ,,	1.96	.68	1.37	.92	.72	.79	.85
10 ,, 11 ,,	.78	.52	.70	.11	.34	.41	.39
11 ,, 12 ,,	.88	.06	.24	.17	.19	.24	.21
ALL DURATIONS	100.00	100.00	100.00	100.00	100.00	100.00	100.00
			<u> </u>				

The proportionate distribution of unemployed males according to duration of unemployment was markedly similar in the cases of the Professional and Commercial Classes on the one hand, and in the cases of the other four classes on the other hand. The former group furnished evidence of larger proportions in the more advanced durations than were furnished by the latter group. For all classes durations from one week to three months accounted for 74.84 per cent. of the unemployed males. The corresponding percentages furnished by the several classes were as follows:—(i.) Professional (63.18 per cent.); (ii.) Domestic (74.64 per cent.); (iii.) Commercial (68.80 per cent.); (iv.) Transport and Communication (78.12 per cent.); (v.) Industrial (76.95 per cent.); (vi.) Primary Producers (73.27 per cent.).

(iv.) Duration of Unemployment of Females.—The number of females shewn in each class of occupation as unemployed is given in the following table, classified according to duration of unemployment, as well as the proportion of each class in each duration:—

Unemployed Females according to Class of Occupation and Duration of Unemployment. Commonwealth, 1911.

	Duration of nemployment.	Class I Pro- fessions	Do-	Class III. Com- mercial.	Class IV. Transport and Com- munica- tion.	Class V. In- dustrial.	Class VI. Primary Fro- ducers.	All Classes.
			NUMBI	ER.		-		
l and und	er 2 weeks	5	9 664	78	3	173		977
2 ,,	3 ,,	7		96	3	207		1,115
3 ,,	4 ,,	6		95	2	177	<b></b>	864
4 ,,	5 ,,	8		117	• • •	227	•••	1,150
5 ,,	6 "		7 133	21	••	47	•••	208
6 ,,	7 "		2 221	48	•••	100		401
7 ,,	8 " 9		6 85	11		$\frac{22}{209}$	1	125 828
0 "	10 "		$egin{array}{c c} 4 & 456 \\ 3 & 21 \\ \end{array}$	98	_	6		36
۱۵ ′′	10 " 11		$\begin{array}{c c} 3 & 21 \\ 1 & 27 \end{array}$	4		14		46
	d under 3 months		4 8	i	::	2		15
	ler 4 months	16		140	3	390	4	1,213
4 ,,	5 ,,		9 162	44	1	123		369
5 ,,	6 ,,		2 91	17		49		179
6 ,,	7,,		3 212	57	2	169	••	493
7 ,,	8 "		4 17	9		19		59
8 ,,	9 ,,		6 17	8		25	•••	66
9 ,, l0 ,,	$\begin{array}{cccc} 10 & " \\ 11 & " \end{array}$		1 28 9 10	10 5		37 16	•••	86 40
11	10 "		1 8	9		5	::	15
.,,	12 ,,			ļ		ļ <u> </u>	<u> </u>	
ALL	DURATIONS	72	4,656	865	16	2,017	5	8,285
		PERCE	NTAGE ON	ALL DUI	RATIONS.			
		0/2	%	%	0/2	%	·%	% .
1 and und	ler 2 weeks	8.13	% 14.26	9.02	% 18.75	8.58	70	11.79
	3 "	9.64					• • •	11.10
2 ,,	4			11.10	18.75	10.26		13.46
3 ,,		8.40	11.36	10.98		8.78		$13.46 \\ 10.43$
3 ,,	5 ,,	11.71	11.36 15.49	$10.98 \\ 13.53$	18.75 12.50	8.78 11.25	••	13.46 10.43 13.88
3 ,, 4 ,, 5 ,,	5 ,, 6 ,,	11.71	11.36 15.49 2.86	10.98 $13.53$ $2.43$	18.75 12.50	8.78 $11.25$ $2.33$	••	13.46 10.43 13.88 2.51
3 ,, 4 ,, 5 ,, 6 ,,	5 ,, 6 ,, 7 ,,	11.71 96 4.41	11.36 15.49 2.86 4.75	10.98 13.53 2.43 5.55	18.75 12.50	8.78 11.25 2.33 4.96	••	13.46 10.43 13.88 2.51 4.84
3 ", 4 ", 5 ", 6 ", 7 ",	5 ,, 6 ,, 7 ,, 8 ,,	11.71 96 4.41 83	11.36 15.49 2.86 4.75 1.83	10.98 13.53 2.43 5.55 1.27	18.75 12.50	8.78 11.25 2.33 4.96 1.09	20.00	13.46 10.43 13.88 2.51 4.84 1.51
3 ,, 4 ,, 5 ,, 6 ,, 7 ,, 8 ,,	5 ,, 6 ,, 7 ,, 8 ,, 9 ,,	11.71 96 4.41 83 8.81	11.36 15.49 2.86 4.75 1.83 9.79	10.98 13.53 2.43 5.55 1.27 11.33	18.75 12.50  6.25	8.78 11.25 2.33 4.96 1.09 10.36	20.00	13.46 10.43 13.88 2.51 4.84
3 ,, 4 ,, 5 ,, 6 ,, 7 ,, 8 ,, 9 ,,	5 ,, 6 ,, 7 ,, 8 ,, 9 ,,	11.71 96 4.41 83	11.36 15.49 2.86 4.75 1.83 9.79 .45	10.98 13.53 2.43 5.55 1.27	18.75 12.50	8.78 11.25 2.33 4.96 1.09	20.00	13.46 10.43 13.88 2.51 4.84 1.51 9.99
3 ", 4 ", 5 ", 6 ", 7 ", 8 ", 9 ", 10 ",	5 ", 6 ", 7 ", 8 ", 9 ",	11.71 96 4.41 83 8.81	11.36 15.49 2.86 4.75 1.83 9.79 .45	10.98 13.53 2.43 5.55 1.27 11.33 .69	18.75 12.50   6.25	8.78 11.25 2.33 4.96 1.09 10.36 .30 .69	20.00	13.46 10.43 13.88 2.51 4.84 1.51 9.99 .44 .56
3 ,, 4 ,, 5 ,, 6 ,, 7 ,, 8 ,, 9 ,, 10 ,, 11 weeks an	5 ", 6 ", 7 ", 8 ", 9 ", 10 ", 11 ", d under 3 months	11.71 96 4.41 83 8.81 141455 23.28	11.36 15.49 2.86 4.75 1.83 9.79 .45 .58 .17	10.98 13.53 2.43 5.55 1.27 11.33 .69 .46 .11 16.18	18.75 12.50   6.25  18.75	8.78 11.25 2.33 4.96 1.09 10.36 .30 .69 .10 19.34	20.00	13.46 10.43 13.88 2.51 4.84 1.51 9.99 .44 .56 .18
3 ,, 4 ,, 5 ,, 6 ,, 7 ,, 8 ,, 9 ,, 10 ,, 11 weeks and 4 ,,	5 ", 6 ", 7 ", 8 ", 9 ", 10 ", 11 ", d under 3 months ler 4 months 5 ",	11.71 96 4.41 83 8.8141 14 55 23.28 5.37	11.36 15.49 2.86 4.75 1.83 9.79 .45 .58 .17 10.89 3.48	10.98 13.53 2.43 5.55 1.27 11.33 .69 .46 .11 16.18 5.09	18.75 12.50   6.25	8.78 11.25 2.33 4.96 1.09 10.36 .30 .69 .10 19.34 6.10	20.00	13.46 10.43 13.88 2.51 4.84 1.51 9.99 .44 .56 .18 14.64 4.45
3 ", 4 ", 5 ", 6 ", 7 ", 8 ", 9 ", 10 ", 11 weeks an 3 and und 4 ", 5 ", "	5 " 6 " 7 " 8 " 9 " 10 " 11 " d under 3 months ler 4 months 5 " 6 "	11.71 96 4.41 83 8.81 14	11.36 15.49 2.86 4.75 1.83 9.79 .45 .58 .17 10.89 3.48 1.95	10.98 13.53 2.43 5.55 1.27 11.33 .69 .46 .11 16.18 5.09 1.97	18.75 12.50  6.25  18.75 6.25	8.78 11.25 2.33 4.96 1.09 10.36 .30 .69 .10 19.34 6.10 2.43	20.00	13.46 10.43 13.88 2.51 4.84 1.51 9.99 .44 .56 .18 14.64 4.45 2.16
3	5 " 6 " 7 " 8 " 9 " 10 " 11 " d under 3 months ler 4 months 5 " 6 " 7 "	11.71 96 4.41 83 8.814155 23.28 5.37 3.03 7.30	11.36 15.49 2.86 4.75 1.83 9.79 .45 .58 .17 10.89 3.48 1.95 4.55	10.98 13.53 2.43 5.55 1.27 11.33 .69 .46 .11 16.18 5.09 1.97 6.59	18.75 12.50  6.25  18.75 6.25  12.50	8.78 11.25 2.33 4.96 1.09 10.36 .30 .69 .10 19.34 6.10 2.43 8.38	20.00	13.46 10.43 13.88 2.51 4.84 1.51 9.99 .44 .56 .18 14.64 4.45 2.16 5.95
3	5 " 6 " 7 " 8 " 9 " 10 " 11 " d under 3 months ler 4 months 5 " 6 " 7 " 8 "	11.71 96 4.41 83 8.814155 23.28 5.37 3.03 7.30 1.93	11.36 15.49 2.86 4.75 1.83 9.79 .45 .58 .17 10.89 3.48 1.95 4.55	10.98 13.53 2.43 5.55 1.27 11.33 .69 .46 .11 16.18 5.09 1.97 6.59 1.04	18.75 12.50  6.25  18.75 6.25 	8.78 11.25 2.33 4.96 1.09 10.36 .30 .69 .10 19.34 6.10 2.43 8.38 .94	20.00	13.46 10.43 13.88 2.51 4.84 1.51 9.99 .44 .56 .18 14.64 4.45 2.16 5.95
3 ", 4 ", 5 ", 6 ", 7 ", 8 ", 9 ", 11 weeks an 3 and und 4 ", 5 ", 7 ", 8 ", 9 ", 9 ", 9 ", 9 ", 9 ", 9 ", 9	5 " 6 " 7 " 8 " 9 " 10 " 11 " d under 3 months ler 4 months 5 " 6 " 7 " 8 " 9 " 10 " 11 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10	11.71 96 4.41 83 8.81 14 55 23.28 5.37 3.03 7.30 1.93 2.20	11.36 15.49 2.86 4.75 1.83 9.79 .45 .58 .17 10.89 3.48 1.95 4.55 .37	10.98 13.53 2.43 5.55 1.27 11.33 .69 .46 .11 16.18 5.09 1.97 6.59 1.04	18.75 12.50  6.25  18.75 6.25 	8.78 11.25 2.33 4.96 1.09 10.36 .30 .69 .10 19.34 6.10 2.43 8.38 .94 1.24	20.00	13.46 10.43 13.88 2.51 4.84 1.51 9.99 .44 .56 .18 14.64 4.45 2.16 5.95 .71 .80
3	5 " 6 " 7 " 8 " 9 " 10 " 11 " d under 3 months ter 4 months 5 ", 6 ", 7 ", 8 ", 9 ", 10 ",	11.71 96 4.41 83 8.81 14 155 23.28 5.37 3.03 7.30 1.93 2.20 1.52	11.36 15.49 2.86 4.75 1.83 9.79 .45 .58 .17 10.89 3.48 1.95 4.55 .37 .37	10.98 13.53 2.43 5.55 1.27 11.33 .69 .46 .11 16.18 5.09 1.97 6.59 1.04 .92	18.75 12.50  6.25  18.75 6.25 	8.78 11.25 2.33 4.96 1.09 10.36 .30 .69 .10 19.34 6.10 2.43 8.38 .94 1.24	20.00  20.00   80.00	13.46 10.43 13.88 2.51 4.84 1.51 9.99 .44 .56 .18 14.64 4.45 2.16 5.95 .71 .80
3 ", 4 ", 5 ", 6 ", 7 ", 8 ", 9 ", 11 weeks an 3 and und 4 ", 5 ", 7 ", 8 ", 9 ", 9 ", 9 ", 9 ", 9 ", 9 ", 9	5 " 6 " 7 " 8 " 9 " 10 " 11 " d under 3 months ler 4 months 5 " 6 " 7 " 8 " 9 " 10 " 11 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10 " 10	11.71 96 4.41 83 8.81 14 55 23.28 5.37 3.03 7.30 1.93 2.20	11.36 15.49 2.86 4.75 1.83 9.79 .45 .58 .17 10.89 3.48 1.95 4.55 .37 .60 .21	10.98 13.53 2.43 5.55 1.27 11.33 .69 .46 .11 16.18 5.09 1.97 6.59 1.04	18.75 12.50  6.25  18.75 6.25 	8.78 11.25 2.33 4.96 1.09 10.36 .30 .69 .10 19.34 6.10 2.43 8.38 .94 1.24	20.00	13.46 10.43 13.88 2.51 4.84 1.51 9.99 .44 .56 .18 14.64 4.45 2.16 5.95 .71 .80

As in the case of males, accumulations at the round durations of one month, two months, three months and six months were strongly in evidence.

For all classes combined durations from one week to three months accounted for 69.59 per cent. of the unemployed females. The corresponding percentages furnished by the several classes were as follows:—Class I., 53.99 per cent.; Class II., 77.41 per cent.; Class III., 66.47 per cent.; Class IV., 56.25 per cent.; Class V., 58.70 per cent.; Class VI., 20 per cent.

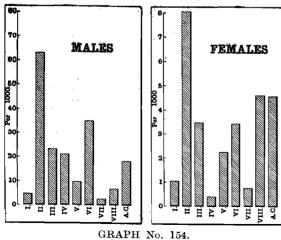
34. Occupation and Race.—On pages 1014 to 1073 of Volume II. of this Report, details are furnished concerning the occupations of persons of Non-European Race (exclusive of full-blooded aboriginals) enumerated at the Census of 3rd April, 1911. The following table furnishes a comparative summary for males of European and Non-European race, and indicates the relation of the number of persons of non-European races in each class of occupation to the total number of males in such class:—

Occupation and Race, Males. 3rd April, 1911. (Exclusive of full-blood Aboriginals).

		-	•	•			·		
			ST	ATES.			TERRIT	ORIES.	
CLASS.	N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH.
		EUROPI	EAN RAC	Е.					
I. Professional	37,100 18,261 87,005 59,813 172,016 199,014 6,752 264,053 844,014	27,189 13,247 75,092 75,745 142,756 145,326 5,750 202,043 649,148	5,604 27,980 22,209 56,385 94,072 2,427 97,001	6,791 3,424 22,580 15,273 44,927 49,677 1,177 62,105 205,954	6,783 3,717 15,172 11,101 23,990 50,289 577 43,621 155,250	3,446 1,489 7,129 4,451 14,992 31,354 548 33,514 96,923	66 34 55 154 95 609 6 94	52 10 17 13 213 397 5 274	45,786 235,030 150,759 455,374 570,738 17,242 702,705
	N	ON-EUR	OPEAN E	LACE,					
I. Professional	175 814 2,389 983 1,709 5,694 31 1,889	116 630 1,111 461 1,159 2,309 4 653	812 1,288 440 1,068 7,263 3 1,403	13 53 210 449 137 281  261	32 645 350 851 298 3,773 2 364 6,315	3 37 91 26 13 361 1 136	7 93 141 40 113 1,082 3 142 1,621	1 2 4 4	3,250 4,497 20,767 44 4,852
	'		'			•		****	,
NUMBER OF NON-EUROPEAN	MALES P.	ER 1000	OF THE	TOTAL N	AALE PO	PULATIO	ON IN E.	AOH CLA	\ss. 
I. Professional	4.69 42.67 26.72 16.17 9.84 27.82 4.57 7.10	4.25 45.40 14.58 12.07 8.05 15.64 .70 3.22	8.74 126,56 44.01 19.43 18.59 71.67 1.23 14.26	1.91 15.24 9.21 28.56 3.04 5.62 	4.70 147.87 22.55 71.20 12.27 69.79 3.45 8.28	.87 24.25 12.60 5.81 .87 11.38 1.82 4.04	95.89 732.28 719.39 206.19 543.27 639.86 333.33 601.69	90.90 105.26  9.98 14.39	4.79 63.13 23.26 21.10 9.78 35.11 2.55 6.86
TOTAL, ALL CLASSES	15.95	9.83	37.57	6.77	39.09	6.84	592.90	11.09	18.38

In all the States except South Australia, Non-European males were most numerous in the Class of Primary Producers. These were made up mainly of Chinese market gardeners and other agriculturists; Polynesian agriculturists; Chinese and half-caste aboriginal pastoral labourers; Japanese, Malay, Filipino, Japanese, Timorese and Papuan pearlers; and Chinese miners. In

Non-European Proportion per 1000 in each Class of Occupation, Commonwealth, 1911.



all the States except South Australia, the Non-European males represented a larger proportion of the males in the Domestic Class than was the case in any other class of occupation. Rather more than  $6\frac{1}{4}$  per cent. of the males in Domestic Class were Non-European, as were also slightly more than  $3\frac{1}{2}$  per cent. of the male Primary Producers.

A representation of the proportion per 1000 which the Non-European members of the community of each sex employed in each class of occupation were of the total numbers of males and females respectively so employed is furnished in Graph 154. The Roman numerals at the feet of the several pillars denote the classes of occupation and have the significance indicated in the preceding table. The letters A. C. denote "All Classes." The scales on the left of the male and female

portions of the Graph represent the proportions per 1000 for each sex. Owing to the smallness of the female proportions, the scale for females has been made ten times as great as that for males.

A return in respect of females, similar to that given on the preceding page for males, is furnished in the next table :—  $\,$ 

Occupation and Race, Females, 3rd April, 1911. (Exclusive of full-blood Aboriginals).

			ST	ATES.			TERRIT	ORIES.	
CLASS.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH.
		triibodi	EAN RAC	Е.					
		MOROLI							
I. Professional	19,361 54,133 18,144	17,311 48,739 17,333	6,273 19,897 5,687	4,613 14,289 4,774	3,474 9,190 2,935 327	2,175 $6,480$ $1,701$	13 21 	8 64 3	152,81 50,57
IV. Transport and Communication V. Industrial VI. Primary Producers	1,596 36,009 5,284 3,396	1,610 46,715 5,764 3,505	621 11,353 3,421 731	350 8,335 1,540 761	$\begin{array}{r} 327 \\ 3,996 \\ 567 \\ 272 \end{array}$	333 2,599 677 443	2	6 4 24 1	109,01 17,27 9,10
III. Dependents	647,145			165,970	98,821	78,977	268	608	1,735,29
TOTAL, ALL CLASSES	785,068	658,772	273,689	200,632	119,582	93,385	305	718	2,132,1
II. Domestic III. Commercial IV. Transport and Communication V. Industrial IV. Primary Producers	391 81 1 106	100 22 1 47	454 46  66	50 12  9	186 6  10	$\begin{bmatrix} 7\\10\\8\\2 \end{bmatrix}$	53 :: 2 11	••	1,2 1 2
VI. Primary Producers	13 5 3,355	$\frac{1}{2}$	13 2,016	<sub>485</sub>	$\frac{11}{752}$	<sub>207</sub>	205	 4	
TOTAL, ALL CLASSES	3,968	1,188	2,618	568	967	235	271	4	9,8
NUMBER OF NON-EUROPEAN FE	MALES PI	ER 1000	OF THE	TOTAL 1	FEMALE	POPULA	TION IN	EACH	CLASS.
I. Professional II. Domestic	.83 7.17 4.44	.64 2.05 1:27	3.65 22.31 8.02	.65 3.49 2.51	$\begin{array}{c} .58 \\ 19.84 \\ 2.04 \end{array}$	.46 1.08 5.84	716.22	::	1.00 8.0 3.4
III. Commercial	.63 2.94	1.01 1.01	5.78 3.79	1.08 5.81	2.50 19.03	3.07 2.95	500.00 916.67	••	2.2 3.4
VII. Independent	1.47 5.16	.5 <b>7</b> 1.94	8.85	2,91	7.55	2.61	433.4	6.54	4.6
_		l	I	2.82	8.02	2.51	470.49	5.54	4.5

Of the total number of females of Non-European race more than 80 per cent. were dependents, the balance belonging mainly to the domestic class.

# CHAPTER XXII.

## DWELLINGS.

- 1. General.—At every Census taken in Australia, with the exception of the New South Wales Censuses of 1833 and 1836, provision has been made for the enumeration of occupied habitations, and in most cases particulars have also been collected concerning the number of houses which were unoccupied or being built at the time of the Census. In all cases, however, it appears doubtful whether complete information has been collected concerning the number of houses which are unoccupied or being built. Particulars have also usually been collected concerning the materials of which the dwellings were built, and in most recent cases, concerning the number of rooms contained. Owing, however, to differences in classification of materials, and to differences in the grouping of the number of rooms, the published returns for the several States furnish results which it is by no means easy to aggregate or to compare.
- 2. Form of inquiry.—At the Australian Censuses prior to that of 1911, the inquiry concerning dwellings was usually made in the two outer columns of the householder's schedule, which was generally a large sheet making provision for full particulars concerning twenty inmates. At the Census of 1911, with the introduction of the card system of collection, a special card was provided for a record of the names of the members of the household, and for the desired particulars concerning the dwellings.

Provision for these latter were made in the following form:

- 1. Nature of Buildings.....
- 2. Material of which outer walls are built.....
- 3. Number of Rooms......
- 4. Owner, Tenant or Rent Purchaser.....
- 5. Weekly Rent payable, or Rent Value per week.....

In the instructions which accompanied the cards the following directions were given:—

**BUILDINGS.**—Line 1.—State whether a private house; a tenement in a private house; an hotel, boarding, or lodging house; a religious or educational institution; a military establishment; a charitable institution; or a penal establishment.

- Line 2.—State whether the outer walls are built of stone, brick, concrete, wood, iron, canvas, or any other material.
- Line 3.—State number of rooms, including kitchen, but excluding shop, office, store, bathroom, pantry, or outhouses, unless some one sleeps therein. In the case of a tenement, give number of rooms in tenement only. In case of a building the only resident whereof is a caretaker, give number of rooms in caretaker's quarters only.
  - Line 4.—Write O if owner; T if tenant; or R P if rent purchaser.

The only buildings enumerated were those which were either used or intended for use as dwellings. Shops, offices, stores, churches, schools, etc., in which no one resided were not enumerated. In all cases dwellings occupied or usually occupied solely by full-blooded aboriginals have been excluded from the tabulation.

3.—Dwellings, occupied, unoccupied and being built.—At the Census of 1911 the total number of dwellings recorded for the Commonwealth as a whole was 960,783, of which 924,259 were occupied dwellings, 33,473 were dwellings, which at the date of the Census were unoccupied, while 3,051 dwellings in course of erection were also recorded at that date. As the returns received from certain districts furnished indications of defective collection in respect of unoccupied dwellings, and those being built the figures for these classes are below the truth, but the extent of the deficiency cannot be readily estimated. In the detailed analysis of the information concerning dwellings, occupied dwellings only have been treated. The complete tabulation of the data in respect of dwellings is contained in Volume III. of the Census Report, pp. 1849-2047. Ships, boats and other craft, the occupants of which were enumerated at the Census, are not included as dwellings in the present chapter, nor in the tables quoted.

The number and proportion of dwellings recorded as occupied, unoccupied and being built in each of the States and Territories at 3rd April, 1911, were as follows:—

DWELLINGS.

Dwellings Occu	pied. Unoccupied	l and Being	Built, 1911.
----------------	------------------	-------------	--------------

•		Num	IBER.		Proportion per cent.				
STATE OR TERRITORY.	Occu- pied.	Unoccu- pied.	Being Built.	Total.	Occu- pied.	Unoccupied.	Being Built.	Total.	
States—	,				%	%	%	%	
New South Wales	. 330,976	10,217	1,191	342,384	96.67	2.98	.35	100.00	
Victoria	272,683	11,246	921	284,850	95.73	3.95	.32	100.00	
Queensland	125,836	3,684	354	129,874	96.89	2.84	.27	100.00	
South Australia	84,179	3,062	420	87,661	96.03	3.49	.48	100.00	
Western Australia	. 68,870	3,158	74	72,102	95.52	4.38	.10	100.00	
Tasmania	40,025	2,077	87	42,189	94.87	4.92	.21	100.00	
Territories—						-			
Northern Territory	. 1,248	23	4	1,275	97.88	1.80	.32	100.00	
Federal Territory	. 442	6		448	98.66	1.34	• •	100.00	
Total, Commonwealth .	924,259	33,473	3,051	960,783	96.20	3.48	.32	100.00	

For the Commonwealth as a whole the number of unoccupied dwellings recorded represented about  $3\frac{1}{2}$  per cent. of the total, while the number being built represented about  $3\frac{1}{4}$  per thousand. Amongst the States, Tasmania, with 4.92 per cent. furnished the largest proportion of unoccupied, followed in succession by Western Australia, with 4.38 per cent., and Victoria with 3.95 per cent. Queensland, with 2.84 per cent., had the lowest proportion of unoccupied dwellings. In the case of houses being built, South Australia with .48 per cent., had the highest and Western Australia with .10 per cent. had the lowest proportion.

- 4. Unspecified data.—Amongst occupied dwellings the extent of the unspecified data was not great in so far as nature of dwellings, materials of outer walls, and number of rooms is concerned, but in the case of the inquiry as to rental value a very large proportion was unspecified. As regards nature of dwellings there were 492 unspecified cases, while there were 4,552 cases of failure to specify the number of rooms, and 5010 cases in which the materials were not stated. Of these the largest represented little more than 5 per 1000 of the total cases. On the other hand, in the case of rental values no fewer than 158,453, or about 17 per cent of the total, failed to specify the rental value of the dwelling.
- 5. **Nature of dwelling.**—The first classification made of the data in respect of occupied dwellings, was one according to the nature of the dwelling, that is, according to whether it was a private house, hotel, boarding house, etc. A tabulation according to this classification of the number of occupied dwellings in each State and Territory is furnished in the following table:—

Nature of Occupied Dwellings, 1911.

NATURE OF DWELLING.			STATES	3.		*	TERRIT	C'wlth	
	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	
Private House	$\begin{vmatrix} 317.462 \end{vmatrix}$	261.977	121,062	80.990	66.199	38,730	1,194	431	888,045
Tenement in Private House	2.304			1.118		220			6,344
Caretaker's Quarters in Store, Offices, &c		280		26	31	28			652
Hotel	2,795				732	383		1	9,106
Boarding House, Lodging House, Coffee	2,.00	2,002	1,010	010		000	1 1	•	0,100
Palace	5,966	4,390	1,400	945	1,041	436	4	5	14,187
Educational Institution	229	173	67	31	41	20			561
Religious Institution (non-Educational)	135		18	29	$\overline{22}$	20			264
Hospital	479		242	97	144	44	3		1,326
Charitable Institution (other than Hos-						_	-		_,
pital)	159	100	55	62	36	18	1		431
Penal Establishment	132	35	17	14	29	9	. 1		237
Military and Naval Establishment	112	28	7	2	5	4	'	4	162
Police Barracks	28	14	23	1	3				. 69
Police Station and Quarters	534	318	256	119	98	69	11	1	1,406
Fire Station	65	56	14	16	22	4			177
Unspecified	68	221	104	50	18	30	1		492
Wagons, Trains, etc	250	145	171	18	15	10			609
Aboriginal Camps in which Whites or									1
Half-castes were Living	21	1	50	18	80	••	21	• •	191
Total Dwellings	330,976	272,683	125,836	84,179	68,870	40,025	1,248	442	924,259
Other Camps without Dwellings	1,865	812	998	258	1,449	86	60	2	5,530

In all States the class most numerously represented was naturally that of private houses. Boarding houses, &c., occupied second place, hotels third place, and tenements in private houses occupied fourth place in the Commonwealth as a whole, as well as in the States of New South Wales, Victoria, Western Australia, and Tasmania. In Queensland, hotels occupied second place, and in South Australia this position was occupied by tenements in private houses. For he purposes of detailed tabulations according to number of rooms and materials of which outer

walls were built, taken in conjunction, as well as for certain other purposes, it was deemed advisable to summarise the classification according to nature of dwelling so as to furnish a main division into "private dwellings" and "dwellings other than private." For this purpose "private houses" and "tenements in private houses" were combined and designated "private dwellings," while all the other classes were grouped together as "dwellings other than private." The percentage which "dwellings other than private" were of the total dwellings in the several States and Territories, and in the Commonwealth as a whole, was as follows:—Commonwealth, 3.23 per cent.; New South Wales, 3.39 per cent.; Victoria, 3.32 per cent.; Queensland, 3.24 per cent.; South Australia, 2.46 per cent.; Western Australia, 3.36 per cent.; Tasmania, 2.69 per cent.; Northern Territory, 4.33 per cent.; Federal Territory, 2.49 per cent.

In addition to the inmates of 924,259 dwellings there were enumerated 5,530 parties of campers out without dwellings.

In the next table is furnished a classification of the occupied dwellings in the Commonwealth, according to nature of dwelling and number of rooms.

Nature of Dwelling and Number of Rooms. Commonwealth, 1911.

NATURE OF DWELLING.	1	Number	of Dy	VELLING	s Conta	INING R	OOMS TO	отне 1	VUMBE	R OF-	
	1	2	3	4	5	6	7	8	9	10	11
Private House	64.886	44,139	70.188	204.687	$ _{190,229}$	147.549	9 75.325	40.62	19.24	3 12.05	4,896
Tenement in Private House	1,633		1,132	1,007			'	,			4 5
Caretaker's Quarters in Store, Offices, etc	126	101	113	110					3	1	2
Hotel Boarding House, Lodging	3	1	••	8		38	92	195	5 27	8 46	508
House, Coffee Palace Educational Institution	6	42	125	395 4	1,014 8						740 7 38
Religious Institution (non- Educational)		1	6	9	10			21	1 1	6 1	6 19
Hospital	••	2	12	34							1 59
(other than Hospital) Penal Establishment	-21 6	29 3	14 8	29 16	. 17 21			1			$\begin{vmatrix} 1 & 13 \\ 8 & 7 \end{vmatrix}$
Military and Naval Establishment	95	7	3	4	9			-			1
Police Barracks Police Station & Quarters	$\begin{array}{c} 2 \\ 22 \end{array}$	4 33	$\begin{array}{c} 6 \\ 51 \end{array}$	5 195	$\begin{array}{c c} 14\\ 369 \end{array}$	1					$\begin{bmatrix} 3 & 1 \\ 0 & 10 \end{bmatrix}$
Fire Station	19	15	17	37	25	19	11	. 11	l	5	4 3
Unspecified Wagons, Trains, etc	3	2	3	9	6	22	2 7	17	11	7 1	8 12
Aboriginal Camps in which Whites or Half-castes			••	•••		.,	''			''	
were Living	• •	• •	• •	• •	• •				••		• •
TOTAL	66,822	45,705	71,678	206,549	192,543	150,662	2 78,019	43,092	21,25	9 13,88	9 6,311
Other Camps without Dwellings						•••					
•	Nu	MBER O	r Dwei	LINGS C	ONTAINI	NG ROO	MS TO T	не Nu	MBER (	)F	
NATURE OF DWELLING.			1	1		1	1		20	Un-	Total.
MATURE OF DWELLING.	- 12	13	14	15	16	17	18		and	speci-	TOTAL.
	_	_	\ <u> </u>	_					ver.	fied.	
Private House	4,04	3 1,677	7 1,600	794	651	. 350	277	127	861	3,843	888,045
Tenement in Private House	• 7.	3	2,50	2					1	90	6,344
Caretaker's Quarters in Store, Offices, etc					1		. 1			59	652
Hotel	73					415	362	238	3,196	125	9,106
Boarding House, Lodging House, Coffee Palace	67	4 414	42	8 277	214	159	140	73	798	78	14,187
Educational Institution	2		9 2			10	20	12	256	3	561
Religious Institution (non- Educational)	1.		3 1:	2 11	8	3	7	3	44	9	264
Hospital	6					19	20	17	171	59	1,326
Charitable Institution		6 12		F 11	9	8	13	4	99	22	431
(other than Hospital) Penal Establishments	10			5 11 5 4		8		2	27	28	237
Military and Naval Estab- lishment		1 :	ı	1			. 1		. 8	8	162
Police Barracks	.	4	1 :	2   1			2	1	3		69
Police Station and Quarter Fire Station			l ; l	3	2	1	1		5	9 2	$1,406 \\ 177$
Unspecified	1				12	8	6	4	62	$22\overline{4}$	492
Wagons, Trains, etc			• •		••	••	••	• •	••	609	609
Aboriginal Camps in which Whites or Half-castes			,							.	
were Living									•••	191	191
TOTAL	5,62	7 2,76	2,91	5 1,709	1,526	973	851	481	5,531	5,352	924,259
Other Camps without Dwellings											5,530
<b>-</b>	1	1	1 "	1	i						

DWELLINGS.

More than half of the "private houses" contained 5 rooms or less, while more than half of the "tenements in private houses" contained 3 rooms or less. Similarly, more than half of the caretaker's quarters contained 3 rooms or less. On the other hand more than half of the "hotels" contained 16 rooms or more, and more than half of the "boarding houses, &c.," contained 8 rooms or more.

The total of 5,531 dwellings enumerated with 20 rooms and over, was made up as follows:

Dwellings containing 20 Rooms and Over. Commonwealth, 19	
	11

Nu	mber of	Rooi	ms.	Private Dwell- ings.	Dwellings other than Private.	Total.	Number	r of Ro	oms.	Private Dwell- ings.	Dwell- ings other than Private.	Total.
•												
20 ar	nd under	25		636	1,921	2,557	60 and	under	70	1	91	92
25	,,	30		129	879	1,008	70	,,	80	<b></b>	49	49
30	,,	35		53	`711	764	80		90	<b>.</b> .	25	.25
35	,,	40		11	283	294	90		00	1	16	16
40		$\frac{1}{45}$		$\frac{1}{22}$	334	356		over	••		63	63
$\frac{1}{45}$	,,	50		3	114	117	100 ana	0.01	• • •	•••		
<del>5</del> 0	"	60	• •	7	183	190	TOTA	<b>-</b>		862	4,669	5,531
90	,,	OO.	• •	'	183	. 190	IOTA	ь	• •	802	4,009	0,031

The following table furnishes for the Commonwealth as a whole as well as for each State and Territory the number of private and other dwellings, the aggregate number of inmates, and the average number of inmates per dwelling:—

Dwellings and Inmates according to Nature of Dwellings. 1911.

		Numb	er of Dwel	lings.	Num	ber of Inn	nates.		ge Numb es per Dv	
State Territor		Private.	Other than Private.	Total.	In Private Dwell- ings.	In Dwellings other than Private.	In all Dwell- ings.	In Private Dwell- ings.	In Dwell- ings other than Private.	In all Dwell- ings.
TATES										
N.S.W.	• •	319,766	11,210	330,976	1,494,504	140,149	1,634,653	4.67	12.50	4.94
Vic.		263,634	9,049	272,683	1,207,716	101,300	1,309,016	4.58	11.19	4.80
Q'land		121,753	4,083	125,836	545,814	53,703	599,517	4.48	13.15	4.76
S.A.	٠. ا	82,108	2,071	84,179	379,622	25,506	405,128	4.62	12.32	4.81
W.A.		66,553	2,317	68,870	245,160	27,767	272,927	3.68	11.98	3.96
Tas.		38,950	1,075	40,025	178,775	11,688	190,463	4.59	10.87	4.76
<b>lerritori</b>	ES-									
N.T.		1,194	54	1,248	2,682	266	2,948	2.25	4.93	2.36
$\mathbf{F}.\mathbf{T}.$		431	11	442	1,653	55	1,708	3.84	5.00	3.86
Total, C	"wlth	894,389	29,870	924,259	4,055,926	360,434	4,416,360	4.53	12.07	4.78

For the Commonwealth as a whole the average number of inmates per private dwelling was 4.53, and the average number per dwelling (other than private) was 12.07. All the States except Western Australia agreed closely with the Commonwealth average in respect of private houses, and all of the States accorded fairly well with the Commonwealth average in respect of other houses. The small average in the case of Western Australian private houses is due in large measure to the relatively large proportion of temporary residences of canvas and iron which there were in Western Australia at the date of the Census.

In addition to the 4,416,360 persons shewn above as inmates of dwellings there were enumerated 11,409 occupants of camps without dwellings, and a shipping population of 27,236, making with the inmates of dwellings the total population of 4,455,005. Details concerning the campers out and the shipping population of the several States and Territories are as follows:—

Campers-out and Shipping Population. 1911.

Particulars.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth.
Occupants of Camps without dwellings	4,030 8,051	1,730 4,805	2,428 3,868	691 2,739	2,171 7,016	172 576	181 181	6	11,409 27,236
TOTAL	12,081	6,535	6,296	3,430	9,187	748	362	6	38,645

6. Number of rooms.—(i.) Private Dwellings.—A classification of the occupied private dwellings of the several States and Territories, according to the number of rooms contained, is furnished in the following table as well as the proportionate distribution, according to number of rooms:—

## Occupied Private Dwellings according to Number of Rooms, 1911.

			s	TATES.	*		Terri	rories.	
Number of Rooms.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth

#### NUMBER OF DWELLINGS.

-			 						_		*	
1			 	20,321	9,679	16,198	3,248	13,893	2,431	613	136	66,519
2			 	14,596	9,429	7,656	4,119	6,418	2,939	283	25	45,465
3			 	24,288	18,054	7,601	9,630	8.316	3,301	111	19	71,320
$4 \dots$			 	70,241	61,913	22,979	21,151	17,656	11,613	81	60	205,694
$5 \dots$			 	75,063	58,107	24,648	16,821	9,680	6,444	45	57	190,865
$6\dots$			 	54,369	48,927	19,366	14,048	5,620	5,442	31	49	147,852
7			 	26,993	26,452	10,779	6.364	2,215	2,603	13	30	75,449
8			 	14,766	14,307	5,650	3,149	1,149	1,626	9	19	40,675
$9 \dots$			 	7,016	6,688	2,812	1,387	536	812	i	7	19,259
10			 	4,487	4,115	1,710	829	336	585	1	8	12,071
11			 ٠	1,987	1,595	665	307	124	217		6	4,901
1 <b>2</b>			 	1,626	1,270	509	299	129	211		2	4,046
13			 	684	543	178	115	56	101	l J		1,677
14			 	643	517	183	117	46	94	l . <b>.</b> l	2	1,602
$15\dots$			 	324	250	98	60	19	43			794
16			 	293	182	74	44	23	34		1	651
17			 	157	100	29	29	13	22			350
18			 	138	71	23	25	7	13			277
19			 	52	40	18	6	3	7		1	127
20 and	over		 	382	276	91	57	23	30		3	862
Unspeci	fied	• •	 	1,340	1,119	486	303	<b>2</b> 91	382	6	6	3,933
Tor	ral.		 	319,766	263,634	121,753	82,108	66,553	38,950	1,194	431	894,389

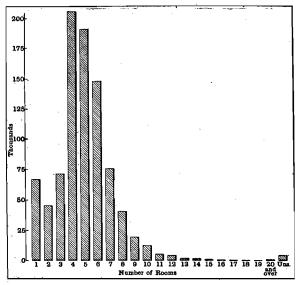
## PERCENTAGE ON TOTAL SPECIFIED.

					%	%	%	%	%.	%	%	%	%
1					6.38	3.69	13.36	3.97	20.97	6.30	51.60	32.00	7.47
$2 \dots$					4.58	3.59	6.31	5.04	9.69	7.62	23.82	5.88	5.11
3					7.63	6.88	6.27	11.77	12.55	8.56	9.34	4.47	8.01
4					22.06	23.58	18.95	25.86	26.65	30.11	6.82	14.12	23.10
$5\dots$					23.57	22.13	20.32	20.56	14.61	16.71	3.79	13.41	21.43
6					17.08	18.64	15.97	17.17	8.48	14.11	2.60	11.53	16.60
7					8.48	10.08	8.89	7.78	3.34	6.75	1.09	7.06	8.47
8					4.64	5.45	4.66	3.85	1.73	4.21	.76	4.47	4.57
$9 \dots$					2.20	2.55	2.32	1.70	.81	2.11	.09	1.65	2.16
lO					1.41	1.57	1.41	1.01	.51	1.52	.09	1.88	1.36
11					.62	.61	.55	.38	.19	.56		1.41	.55
l2	٠.				.51	.48	.42	.36	.19	.55		.47	.46
l3					.22	.21	.15	.14	.08	.26			.19
14					.20	.20	.15	.14	.07	.24		.47	.18
l5					.10	.09	.08	.07	.03	.11			.09
l6					.09	.07	.06	.05	.03	.09		.24	.07
17					.05	.04	.02	.04	.02	.06			.04
l8					.04	.03	.02	.03	.01	.03			.03
19					.02	.01	.01	.01	.00	.02		.24	.01
20 and	over	• •	• •	• •	.12	.10	.08	.0.7	.04	.08		.70	.10
To	ral.	••			100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

In four of the States, viz., New South Wales, Victoria, South Australia, and Tasmania, private dwellings having 4, 5 and 6 rooms represented more than 60 per cent. of the total private dwellings, the respective percentages being as follows:—New South Wales, 63.71 per cent.; Victoria, 64.35 per cent.; South Australia, 63.59 per cent.; Tasmania, 60.93 per cent. In the case of Queensland the corresponding percentage was 55.24 per cent., while in Western Australia it was as low as 49.74 per cent. In the two last mentioned States the number of single roomed dwellings was large, representing 13.36 per cent. of the total in the case of Queensland, and 20.97 per cent. of the total in the case of Western Australia. Two and three-roomed private dwellings were also proportionately more numerous in Western Australia than

in the other States. The relatively heavy number of small dwellings in Queensland and Western Australia is largely due to the comparative recency of the settlement and develop-

# Number of Occupied Private Dwellings according to Number of Rooms, Commonwealth, 1911.



GRAPH No. 155.

ment of considerable areas of each of these States. In all the States the number of private dwellings containing more than eight rooms is relatively small. Thus in Commonwealth as a whole the number of private dwellings containing 9 rooms or upwards is only 5.24 per cent. of the total private dwellings. The corresponding percentages for the several States are as follows:—New South Wales, 5.58 per cent.; Victoria, 5.96 per cent.; Queensland, 5.27 per cent.; South Australia, 4.00 per cent.; Western Australia, 1.98 per cent.; Tasmania, 5.63 per cent.

The accompanying graph (No. 155) furnishes a representation of the number of private dwellings recorded as containing the number of rooms specified. The figures at the feet of the pillars denote the number of rooms contained, while the scale on the left margin indicates the number of thousands of such private

dwellings recorded. The pillar marked "Uns." represents the number of private dwellings for which the number of rooms was unspecified.

(ii.) Dwellings other than private.—A similar classification of the occupied dwellings other than private in the several States and Territories is furnished in the next table :—

# Occupied Dwellings (other than Private) according to number of Rooms, 1911.

			s	TATES.			TERRIT	rories.	
Number of Rooms.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH

#### NUMBER OF DWELLINGS.

						·							
					171	62	39	10	13	5	1	2	303
$1 \dots$	• •	• •	• •	• •	84	60	40	19	26	5	5	1	240
$2 \dots$	• •	• •	• •	• •		80	61	17	62	16	3		358
3			• •	• •	119		95	82	154	66	5		855
4				•••	280	173		146	172	52	ĭ	3	1,678
5					677	424	203		169	77	4	ĭ	2,810
6					1,340	769	231	219	142	57	-	1	2,570
7					1,117	824	264	166			2	1	2,417
8				\	900	860	254	151	159	90	$\frac{2}{2}$	- 1	2,000
9					763	712	212	111	139	61	1	•••	1,818
lo					637	656	228	96	139	61	- 1	•••	1,410
li					507	<b>529</b> .	157	81	98	37	1	••	
$12 \dots$					509	569	214	99	112	78		•••	1,581
• •	• •				404	350	154	63	70	44	1	2	1,088
	• •				483	389	206	109	85	41	• • -	• •	1,313
14	• •	• •			318	301	135	66	62	32	1	• •	915
15	• •	••	• •	- : :	300	244	142	85	65	38	1	• •	875
16	• •	• •	• •		215	190	102	39	48	29			623
17	• •	• •	• •	l	186	173	92	49	47	27			574
18	• •	• •	• •	•••	108	96	76	26	33	15			354
19	• •	• •	• •		1,637	1,229	836	349	393	221	3	1	4,669
20 and	over	• •	• •	•••	184	213	121	52	34	13	. 2		619
Unspeci	ified	• •	• •	• • •	250	145	171	18	15	10	\		609
Wagons	, Trair	is, etc.			230	140	1.1	10			Ţ		ļ
Aborigi	nal Can	nps in V	vnich v	vnites		1	50	18	80		21		191
or He	alf-caste	es were	Living	• •	21	1	90						
To	TAL				11,210	9,049	4,083	2,071	2,317	1,075	54	11	29,870

Occupied Dwellings (other than Private) according to Number of Rooms, 1911-continued.

							8	STATES.			TERRI	TORIES.	
	NUMB	ER OF	Rooms.		N.S.W.	Vie.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlti
	,		í	P	ERCEN'	rage (	ON TOT	AL SPE	CIFIEI	).	1		
					%	0/	%	%	%	%_	%	0/	. <sub>0/</sub>
1					1.59	% .71	1.04	.50	.59	.48	3.23	18.18	1.06
2					.78	.69	1.07	.96	1.19	.48	16.13	9.09	.84
3					1.11	.92	1.63	.86	2.83	1.52	9.68		1.26
4					2.60	1.99	2.54	4.14	7.04	6.27	16.13	::	3.0
5					6.30	4.88	5.43	7.36	7.86	4.94	3.23	27.28	5.90
6					12.46	8.85	6.17	11.04	7.72	7.32	12.90	9.09	9.88
7					10.39	9.48	7.06	8.37	6.49	5.42			9.03
8					8.37	9.90	6.79	7.61	7.27	8.56	6.45	9.09	8.50
9					7.09	8.19	5.67	5.60	6.35	5.80	6.45		7.03
lO					5.92	7.55	6.09	4.84	6.35	5.80	3.23		6.39
1					4.71	6.09	4.20	4.08	4.48	3.52	3.23		4.96
2					4.73	6.55	5.72	4.99	5.12	7.41		l	5.56
3					3.76	4.03	4.12	3.18	3.20	4.18	3.22	18.18	3.82
4					4.49	4.48	5.51	5.50	3.89	3.90			4.61
5	• • .				2.96	3.46	3.61	3.33	2.84	3.04	3.22		3.22
6					[2.79]	2.81	3.79	4.29	2.97	3.61	3.22		3.07
7	• •				2.00	2.19	2.72	1.97	2.19	2.76		<b>.</b> .	2.19
8		• •			1.73	1.99	2.46	2.47	2.15	2.57			2.02
9	` • •				1.00	1.10	2.03	1.31	1.51	1.42			1.24
0 and	over	• •	• •	• •	15.22	14.14	22.35	17.60	17.96	21.00	9.68	9.09	16.41
$\mathbf{T}\mathbf{c}$	TAL				100.00	100.00	100.00	100.00	100.00	100.00	100.00	10.000	10.000

It will be seen from the above table that amongst dwellings other than private there is no strongly-marked tendency to concentrate in a limited group such as is shewn in the case of private dwellings for the group comprising dwellings of 4, 5 and 6 rooms. For the Commonwealth as a whole, and also for most of the States, the dwellings other than private of 6, 7, 8, and 9 rooms preponderate, but for the Commonwealth such dwellings represent only 34.44 per cent. of the total. The corresponding percentages for the several States are as follows:—New South Wales, 38.31 per cent.; Victoria, 36.42 per cent.; Queensland, 25.69 per cent.; South Australia, 32.62 per cent.; Western Australia, 27.83 per cent.; and Tasmania, 27.10 per cent. In all the States a large proportion of the dwellings other than private contains 20 rooms or more, the proportion of such being 16.41 per cent. for the Commonwealth, and varying in the several States between the limits of 14.14 per cent. in the case of Victoria, and 21 per cent. in that of Tasmania.

(iii.) All Dwellings.—A combination of the results concerning private and other dwellings that were occupied is furnished in the succeeding table:—

Occupied Dwellings (Private and Other), according to Number of Rooms. 1911.

								STATES.			TERRIT	ORIES.	
	Numb	ER OF	Rooms.		N.S.W	Vic.	Q'land	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH
		`			NU	MBER	OF DWI	LLING	s		1 1		
1					20,492	9,741	16,237	3,258	13.906	2,436	614	138	66,822
$2 \dots$					14,680	9,489	7,696	4,138	6,444	2,944	288	26	45,705
3					24,407	18,134	7,662	9,647	8,378	3,317	114	19	71,678
4					70,521	62,086	23,074	21,233	17,810	11,679	86	60	206,549
5					75,740	58,531	24,851	16,967	9,852	6,496	46	60	192,543
6					55,709	49,696	19,597	14,267	5,789	5,519	35	50	150,662
7					28,110	27,276	11,043	6,530	2,357	2,660	13	30	78,019
8					15,666	15,167	5,904	3,300	1,308	1,716	11	20	43,092
$9 \dots$					7,779	7,400	3.024	1,498	675	873	3	7	21,259
10				٠.	5,124	4,771	1,938	925	475	646	2	8	13,889
11					2,494	2,124	822	388	222	254	ī	6	6,311
$12\dots$					2,135	1,839	723	398	241	289		$\mathbf{\hat{2}}$	5.627
13				٠	1,088	893	332	178	126	145	1	$ar{f 2}$	2,765
14					1,126	906	389	226	131	135		$\bar{2}$	2,915
$15\dots$					642	551	233	126	81	75	1		1,709
$16\dots$					593	426	216	129	88	72	ī [	1	1,526
17					372	290	131	68	61	51			973
18			• •		324	244	115	74	54	40			851
19				٠.	160	136	94	32	36	$\tilde{22}$		1	481
20 and	over				2,019	1,505	927	406	416	251	3	4	5,531
Unspeci	ified				1,524	1,332	607	355	325	395	8	6	4,552
Wagons	, Trair	as, etc.			250	145	171	18	15	10		• •	609
Aborigi	nal Can	nps in	which W	hites			***			-	• •	• •	500
or He	lf-caste	s were	Living		21	1	50	18	80		21		191
To:	<b>FAL</b>				330,976	272,683	125,836	84,179	68,870	40,025	1,248	442	924,259

Occupied D. ellings (Private and Other, accor ing to Member of Rooms, 1911-cominued.

							STA	TES.			Terri	TORIES.	
	Numbi	ER -OF	Rooms	•	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlt
				. ]	PERCEN	TAGE	ON TO	CAL SP	ECI <b>FI</b> E	D.			
١					% 6.23	% 3.59	% 12.99	% 3.89	20.32	% 6.15	50.37	% 31.65	7.2
2					4.46	3.50	6.16	4.94	9.41	7.43	23.63	5.96	4.9
3					7.41	6.69	6.13	11.51	12.24	8.37	9.35	4.36	7.8
4					21.42	22.89	18.46	25.34	26.02	29.48	7.05	13.76	22.4
5					23.01	21.58	19.88	20.25	14.39	16.40	3.77	13.76	20.9
3					16.92	18.33	15.68	17.03	8.46	13.93	2.87	11.47	16.4
7				٠	8.54	10.06	8.83	7.79	3.44	6.71	1.07	6.88	8.4
3					4.76	5.59	4.72	3.94	1.91	4.33	.90	4.59	4.6
Э					2.36	2.73	2.42	1.79	.99	2.20	.25	1.60	2.3
)					1.56	1.76	1.55	1.10	.69	1.63	.17	1.83	1.5
l					.76	.78	.66	.46	.33	.64	.08	1.38	.6
2					.65	.68	.58	.48	.35	.73		.46	
3					.33	.33	.27	.21	.18	.37	.08	.46	.:
1					.34	.33	.31	.27	.19	.34		.46	.:
<b>5</b>					.20	.20	.19	.15	.12	.19	.08		
3					.18	.16	.17	.15	.13	.18	.08	.23	.]
7					.11	.11	.10	.08	.09	.13	٠.		.1
3	• •				.10	.09	.09	.09	.08	.10			.0
·					.05	.05	.07	.04	.05	.06		.23	.0
and	over	••	• •	• •	.61	.55	.74	.49	.61	.63	.25	.92	.6
То	TAL				100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.0

Owing to the preponderance of private dwellings the proportions shewn in the above table differ but slightly from those shewn on p. 400 for private dwellings only. The principal difference is that in practically all cases in the above table the proportions for dwellings of 6 rooms and under are somewhat less, and the proportions for dwellings containing more than 6 rooms are somewhat greater than is the case with private dwellings only. Dwellings of 4, 5 and 6 rooms represent 59.83 per cent. of the Commonwealth total, the corresponding totals for the several States being as follows:—New South Wales, 61.35 per cent.; Victoria, 62.80 per cent.; Queensland, 54.02 per cent.; South Australia, 62.62 per cent.; Western Australia, 48.87 per cent.; Tasmania, 59.81 per cent.

(iv.) Inmates of private dwellings.—The next table furnishes a classification according to size of dwelling of the population that was enumerated as residing in private dwellings, at the date of the Census. The figures are given separately for each State and Territory, and the proportionate distribution of such residents according to size of dwelling is also shewn.

Inmates of Occupied Private Dwellings, according to Number of Rooms. 1911.

							8	STATES.	•		TERRIT	ORIES.	÷
1	Numbei	R OF	Rooms.		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH
			. ,		N	UMBEF	R OF IN	MATES	).				
1 2	••				28,656 38,541	13,015 $23,582$	24,619 $21,394$	5,094 11,926			783 643	192 55	
3					88,295	63,728	28,500	36,677	28,731	13,075	400	82	259,488
$\begin{array}{c} 4 & \dots \\ 5 & \dots \end{array}$	• •	• •	• •	٠.	303,967 366,640	260,270 $272,491$	101,707   119,958	$93,192 \\ 81,072$		$53,326 \\ 31,934$	$\frac{327}{193}$	$\frac{225}{269}$	
6					295,975			74,860		29,320	167	301	783.45
ĭ					155,418	142,659	62,426	35,663		14,530	67	191	
8					89,280	80,882	34,945	18,818	7,049		57	120	240,51
9					44,352	39,241	18,262	8,572	3,457	4,815	15	31	118,74
10					29,588	25,036	11,758	5,157	2,282	3,563	4	. 55	
11		· .			13,539	10,090	4,790	2,033			• •	36	,-
$12 \dots$					11,718	8,363	4,022	1,989		1,362		13	
13	• • •	• •		• •	5,210	3,694	1,358	806		664	• •		12,160
14	• •	• •	• •	• •	5,007	3,662	1,556	. 818		652	• •	21	
15	• •	• •	• • .	• •	2,681	1,869	$\frac{1,031}{797}$	398 312		299 268	• •		6,450 5,32°
$egin{smallmatrix} 16 & \dots & 17 & \dots \end{smallmatrix}$	• •	• •	••	• •	$2,360 \ 1,427$	$\substack{1,367\\812}$	$\begin{array}{c} 797 \\ 267 \end{array}$	205		141	• •		2,98
1.0	• •	* **	• •	• •	1,260	621	$\begin{array}{c} 207 \\ 275 \end{array}$	168	76	97	• •	• •	2,986 2,49'
18 19	.••	• •	• •	• •	506	$\begin{array}{c} 372 \\ 372 \end{array}$	$\frac{273}{209}$	68	26	45	• •	4	1,230
10 20 and o	 Mor		• •		4,172	2,565	1,842	454		214	••	31	9,543
Unspecif		• •	• • •		5,912	4,463	2,322	1,340		1,675	$^{\cdot \cdot}_{26}$	14	
Тот	AL		, .		1,494,504	1,207,716	545,814	379,622	245,160	178,775	2,682	1,653	4,055,926

Inmates of Occupied Private Dwellings, according to Number of Rooms, 1911—continued.

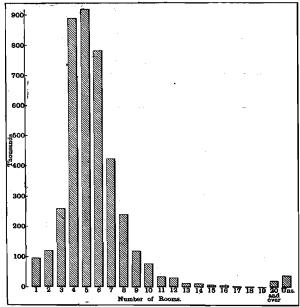
		s	TATES.			TERRIT	rories.	
NUMBER OF ROOMS.	N.S.W. Vio	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH.

PERCENTAGE ON TOTAL SPECIFIED.

-				%	%	%	%	%	%	%	%	_%
1			 	 1.93	1.09	4.53	1.35	7.63	2.00	29.48	11.71	2.34
2			 	 2.59	1.96	3.94	3.15	6.51	4.83	24.21	3.36	2.99
3			 	 5.93	5.30	5.24	9.69	11.77	7.38	15.06	5.00	6.42
4			 	 20.42	21.63	18.71	24.64	30.66	30.11	12.31	13.73	21.98
5			 	 24.63	22.65	22.07	21.43	19.23	18.03	7.27	16.41	22.76
6			 	 19.88	20.69	19.09	19.79	12.35	16.56	6.29	18.37	19.40
7			 	 10.44	11.86	11.49	9.43	5.19	8.20	2.52	11.65	10.49
8			 	 6.00	6.72	6.43	4.97	2.89	5.29	2.15	7.32	5.96
9		٠.,	 	 2.98	3.26	3.36	2.27	1.42	2.72	.56	1.89	2.94
0			 	 1.99	2.08	2.16	1.36	.94	2.01	.15	3.36	1.92
			 	 .91	.84	.88	.54	.35	.75		2.20	.81
12			 	 .79	.69	.74	.53	.38	.77		.79	.70
13			 	 .35	.31	.25	.21	.18	.37			.30
<b>14</b>			 	 .34	.30	.29	.22	.14	.37	l	1.28	.30
			 	 .18	.15	.19	.11	.07	.17	١	'	.16
			 	 .16	.11	.15	.08	.09	.15		.79	.13
_			 	 .09	.07	.05	.05	.05	.08			.07
18			 	 .08	.05	.05	.04	.03	.06			.06
L9			 • •	 .03	.03	.04	.02	.01	.03		.25	.03
	and		 	 .28	.21	.34	.12	.11	.12		1.89	.24
	Тот	AL	 	 100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Of the total of 4,039,018 persons recorded as inmates of private dwellings of which the number of rooms was stated, no fewer than 2,590,753, or 64.14 per cent., were resident in dwellings

Inmates of Private Dwellings according to Number of Rooms, Commonwealth, 1911.



GRAPH No. 156.

of 4, 5 or 6 rooms. The corresponding percentages for the several States were as follows:—New South Wales, 64.93 per cent.; Victoria, 64.97 per cent.; Queensland, 59.87 per cent.; South Australia, 65.86 per cent.; Western Australia, 62.24 per cent.; Tasmania, 64.70 per cent. The inmates of private dwellings in the Commonwealth may be divided into four fairly well defined groups as follows:—

Inmates of dwellings of less than 4 rooms 11.75 per cent.

Inmates of dwellings of 4 to 6 rooms 64.14 per cent.

7 to 9 rooms 19.39 per cent.

,, 10 rooms and more 4.72 per cent.

A representation of the number of inmates of private dwellings of different sizes is furnished in Graph No. 156. The figures at the feet of the pillars denote the number of rooms contained, while the scale on the left margin indicates the number of thousands of

inmates resident in such dwellings. The pillar marked "Uns." represents the number of inmates of private dwellings for which the number of rooms was unspecified.

(v.) Inmates of dwellings other than private.—A similar tabulation in respect of dwellings other than private is furnished in the next table;—

## Inmates of Dwellings other than Private, according to Number of Rooms, 1911.

		· ·	s	TATES.			TERRIT	rories.	
Number of Rooms.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH

#### NUMBER OF INMATES.

													,
1					695	149	63	12	16	9	1	. 4	949
2		• •	• • •	• • •	247	133	159	94	95	. 10	8	6	752
3		• •			506	251	330	68	200	53	7	•	1,415
4		•••	• • •	• •	1,291	881	418	388	669	326	17	• •	3,990
5	• • •	• • •			3,909	2,311	1,170	898	962	278	i i	21	9,550
6					9,132	4,934	1,492	1,755	1,161	490	23	. 6	18,993
7		• •		• •	8,528	6,149	1,962	1,397	1,059	391	-	J	19,486
8	• •	• •	• •		8,178	6,696	2,037	1,458	1,366	630	17		20,386
9 . :	• •	• •	• •	• •	7,510	5,889	1,959	989	$\begin{array}{c c} 1,300 \\ 1,246 \end{array}$	467	8	_	18,068
0	• •	• •	• •	٠.	6,892	6,266	2,231	1,032	1,555	516	3	• •	
1	• •	• •	• •	• •	5,249	4,335	1,624	942	971	299		• •	18,49
ο ΄	• •	• • •	• •		5,249		2,623			657	4	• • •	13,42
		• •	• •	• •	4,239	$\frac{4,788}{3,171}$	1,825	1,093 739	1,185	436	15	iı	15,640
4	• •	• •	• •	• •					$\begin{array}{c c} 1,021 \\ 934 \end{array}$		-		11,457
	• • •	• •	٠.	• •	5,951	3,581	2,538	1,157		475	.;	• •	14,634
5 6	• •	• • •	• •	• •	3,865	3,037	1,707	671	729	324	13	• •	10,346
_	• •	• •	• • •	• •	3,743	2,536	1,789	971	905	348	23	• •	10,31
7	• •	• •	• •		2,897	2,260	1,306	444	508	308	• •	• •	7,72
8	• •		• •	• •	2,564	2,131	1,223	659	780	288	• •		7,645
9	• •		• •	• •	1,639	1,657	1,008	485	603	223			5,61
0 and					45,442	34,006	23,793	7,365	9,862	4,762	65	3.	125,29
Jnspeci	$\mathbf{fied}$				11,067	5,851	1,872	2,758	1,714	379	.14		23,65
Vagons	, Trair	as, etc.			1,160	287	354	37	21	19			1,87
borigir	nal Can	aps in v	vhich V	Vhites				1		1 1	i		
		s were			151	-1	220	. 94	205	••	47	• •	718
Tor	CAL				140,149	101,300	53,703	25,506	27,767	11,688	266	55	360,43

#### PERCENTAGE ON TOTAL SPECIFIED.

						I .	· · · · · · · · · · · · · · · · · · ·		ı	l	i i		1
					% .54	%	%_	%_	%	%	%	_%_	%
1		• •	• •		.54	.16	.12	.05	.06	.08	.49	7.27	.28
$2\dots$					.19	.14	.31	.42	.37	.09	3.90	10.91	.23
3					.40	.26	.64	.30	.77	47	3.42		42
4					1.01	.93	.82	1.72	2.59	2.89	8.29		1.19
5					3.06	2.43	2.28	3.97	3.73	2.46	.49	38.18	2.86
6					7.15	5.18	2.91	7.76	4.50	4.34	11.22	10.91	5.68
7					6.67	6,46	3.83	6.18	4.10	3.46			5.83
8					6.40	7.04	3.97	6.45	5.29	5.58	8.29	7.27	6.10
8 9					5.88	6.19	3.82	4.37	4.82	4.14	3.90		5.41
10					5.39	6.58	4.35	4.56	6.02	4.57	1.46		5.53
11					4.11	4.56	3.17	4.17	3,76	2.65	1.95		4.02
12					4.14	5.03	5.12	4.83	4.59	5.82			4.68
13				•	3.32	3.33	3.56	3.27	3.95	3.86	7.32	20.00	3.43
14					4.66	3.76	4.95	5.12	3.62	4.21			4.38
Î5					3.02	3.19	3.33	2.97	2.82	2.87	6.34		3.10
16					2.93	2.67	3.49	4.29	3.50	3.08	11.22		3.09
17	• • •	• • •	• • •		2.27	2.37	2.55	1.96	1.97	2.73			2.31
îs	• • •		• •		2.01	2.24	2.39	2.91	3.02	2.55			2.29
19					1.28	1.74	1.97	2.14	2.33	1.97		::	1.68
	over	• •	••	• •	35.57	35.74	46.42	32.56	38.19	42.18	31.71	5.46	37.49
∠v and	over	••	• •	• •	30,01	00.74	70.72	52.00	00.10	12.10	01.11	0.10	01.10
To	rat.				100.00	100.00	100.00	10( .00	100.00	100.00	100.00	100.00	100.00
		•	•		-55.00		-55.00	-5.100	=====================================	1			

In all the States the inmates of dwellings other than private which contain 20 rooms or more represent a large proportion of the total inmates of non-private dwellings. For the Commonwealth the percentage was 37.49, and amongst the States it varied between the limits of 32.56 per cent. in South Australia, and 46.42 per cent. in Queensland. For smaller dwellings the maximum for the Commonwealth as a whole was attained by those containing 8 rooms, but the distribution over the long range from 5 to 18 rooms does not present any marked tendency towards concentration.

<sup>(</sup>vi.) Inmates of all dwellings (private and other).—A combination of the information respecting inmates for all dwellings (private and other) is furnished in the succeeding table, the dwellings being classified as before according to the number of rooms in each.

Inmates of all Dwellings (Private and Other), Classified according to Number of Rooms in Dwellings. 1911.

All the second s		· ·	S	TATES.			Terri	rories.	
Number of Rooms.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth

## NUMBER OF INMATES.

								_					
1					29,351	13,164	24,682	5,106	18,639	3,555	784	196	95,477
$2 \dots$					38,788	23,715	21,553		15,994	8,565	651	61	121,347
3					88,801	63,979	28,830	36,745	28,931	13,128	407	82	260,903
4					305,258	261,151		93,580	75,482	53,652	344	225	891,817
5					370,549	274,802		81,970	47,874	32,212	194	290	929,019
6					305,107	253,868	105,268	76,615	31,285	29,810	190	307	802,450
7					163,946	148,808	64,388	37,060	13,722	14,921	67	191	443,103
8					97,458	87,578	36,982	20,276	8,415	9,996	74	124	
9					51,862	45,130	20,221	9,561	4,703	5,282	23	31	136,813
10			<b>4</b> .		36,480	31,302	13,989	6,189	3,837	4,079	7	55	95,938
11					18,788	14,425	6,414	2,975	1,824	1,627	4	36	46,093
12					17,012	13,151	6,645	3,082	2,106	2,019		13	44,028
13					9,449	6,865			1,455	1,100	15	11	23,623
14					10,958	7,243			1,286	1,127		21	26,704
l5			••		6,546	4,906	2,738		907	623	13		16,802
16					6,103	3,903	2,586	1,283	1,115	616	23	13	15,642
17					4,324	3,072	1,573		644	449			10,711
18					3,824	2,752	1,498	827	856	385		1	10,142
19				'	2,145	2,029	1,217	553	629	268		4	6,845
20 and	d over				49,614	36,571	25,635	7,819	10,127	4,976	65	34	134,841
Unspe	cified				16,979				2,870	2,054	40	14	
	ns, Trains	, etc.			1,160	287	354	37	21	19			1,878
Aboria	ginal Cam	ps in	which V	Vhites									, , ,
	Ialf-castes				151	1	220	94	205		47	• •	718
Тот	AL INMAT	ES OF	Dweli	LINGS	1,634,653	1,309,016	599,517	405,128	272,927	190,463	2,948	1,708	4,416,360

## PERCENTAGE ON TOTAL SPECIFIED.

1					% 1.82	% 1.01	% 4.15	% 1.27	% 6.91	% 1.89	% 27.40	% 11.57	% 2.18
2	• •	• •	• •	• • •	2.40	1.83	3.62	3.00	5.93	4.55	$\frac{27.40}{22.75}$	3.60	$\frac{2.16}{2.78}$
9	• •	• •	• •		5.49	4.93	4.85	9.17	10.72	6.97	14.23	4.84	5.97
3 4					18.89	20.11	17.17	23.34	27.97	28.48	12.02	13.28	20.39
$\overline{5}$				• • •	22.92	21.16	20.37	20.45	17.74	17.10	6.78	17.12	21.24
6				• • •	18.88	19.55	17.70	19.11	11.59	15.82	6.64	18.12	18.3
ž					10.14	11.46	10.83	9.24	5.09	7.92	2.34	11.28	10.13
8					6.03	6.74	6.22	5.06	3.12	5.31	2.59	7.32	5.9
9					3.21	3.48	3.40	2.38	1.74	2.80	.80	1.83	3.13
0					2.26	2.41	2.35	1.54	1.42	2.17	.25	3.25	2.1
l					1.16	1.11	1.08	.74	.68	.86	.14	2.12	1.03
2					1.05	1.01	1.12	.77	.78	1.07		.77	1.0
3					.58	.53	.54	.39	.54	.58	.53	.65	.54
4					.68	.56	.69	.49	.48	.60		1.24	.6
<b>5</b>					.40	.38	.46	.27	.34	.33	.46		.3
6		٠,			.38	.30	.43	.32	.41	.33	.80	, ,77	.3
7					.27	.24	.26	.16	.24	.24		• •	.2
8	• •			٠.	.24	.21	.25	.21	.32	.20		• •	.2
9					.13	.16	.20	.14	.23	.14		.24	.10
0 and	over	٠.	• •	• •	3.07	2.82	4.31	1.95	3.75	2.64	2.27	2.00	3.0
To	TAL			٠,	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.0

The inmates of all dwellings may conveniently be divided into four groups as follows:—

Inmates of dwellings of less than 4 rooms 10.93 per cent.

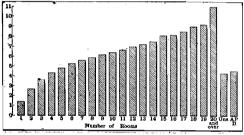
- ", 4 to 6 rooms 59.98 ",
  ", 7 to 9 rooms 19.23 ",
  ", 10 rooms and more 9.86 ",
- (vii.) Inmates per private dwelling.—The next table furnishes for each size of dwelling, the average number of inmates per private dwelling in the Commonwealth and the several States and Territories:—

Average Number of Inmates per Private Dwelling, 1911.

							STA	TES.			TERRI	TORIES.	
-	Numbe	R OF	Rooms.		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH
1					1.410	1.345	1.520	1.568	1.340	1.459	1.277	1.412	1.421
	• •				2.641	2.501	2.794	2.895	2.477	2.911	2.272	2.200	2.652
$\frac{2}{3}$					3.635	3.530	3.750	3.809	3.455	3.961	3.604	4.316	3.638
4					4.327	4.204	4.426	4.406	4.237	4.592	4.037	3.750	4.316
5					4.884	4.689	4.867	4.820	4.846	4.956	4.289	4.719	4.817
6					5.444	5.088	5.359	5.329	5.360	5.388	5.387	6.143	5.299
7					5.758	5.393	5.791	5.604	5.717	5.582	5.154	6.367	5.615
8	• •				6.046	5.653	6.185	5.976	6.135	5.760	6.333	6.316	5.913
9					6.322	5.867	6.494	6.180	6.450	5.930	15.000	4.429	6.166
10					6.495	6.084	6.876	6.221	6.792	6.091	4.000	6.875	6.416
1,1					6.814	6.326	7.203	6.622	6.879	6.120		6.000	6.666
12					7.207	6.585	7.902	6.652	7.140	6.455	• • •	6.500	7.016
13				٠.	7.617	6.803	7.629	7.009	7.750	6.574	• • •		7.255
14					7.787	7.083	8.503	6.991	7.652	6.936		10.500	7.533
15					8.275	7.476	10.520	6.633	9.368	6.953	• • :		8.131
16					8.055	7.511	10.770	7091	9.130	7.882	• •	$13\ 000$	8.183
17					9.089	8.120	9.207	7.069	10.462	6.409			8.537
18					9.130	8.746	11.957	6.720	10.857	7.462			9.014
19					9.731	9.300	11.611	11.333	8.667	6.429		4.000	9.685
	${f d}$ over				10.921	9.293	20.242	7.965	11.522	7.133		10.333	11.071
Unspec	eified	• •	••	• •	4.412	3.988	4.778	4.422	3.973	. 4.385	4.333	2.333	4.299
All Pri	ivate D	velling	s		4.674	4.581	4.483	4.623	3.684	4.590	2.246	3.835	4.535

In all the States the average number of inmates increases with the number of rooms. In each State this average is greater than the number of rooms for dwellings up to and including

Average Number of Inmates per Private Dwelling, Commonwealth, 1911.



GRAPH No. 157.

those containing 4 rooms, but is less than the number of rooms for dwellings of 5 rooms and upwards.

In the accompanying graph (No. 157) a representation is furnished of the average number of persons per dwelling for private dwellings of different sizes. The figures at the feet of the pillars denote the number of rooms contained, while the scale on the left denotes the average number of inmates per dwelling. The pillar marked "Uns" represents the average number of inmates per dwelling in the case of private dwellings for which the number of rooms was unspecified, while that marked "A.P.D." represents

the average number of inmates per dwelling when all private dwellings are considered irrespective of size.

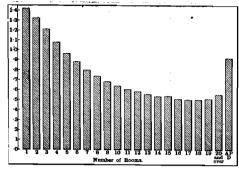
(viii.) Inmates per room in private dwellings.—A further analysis of the data relative to the number of inmates, gives the average number of inmates per room in each class of dwelling. Particulars in respect of private dwellings for the Commonwealth and each of the States and Territories are furnished in the succeeding table:—

Average Number of Inmates per Room, Private Dwellings. 1911.

	•						s	ȚATES.			TERRIT	ORIES.	
Numb	ER OF RO	oms n	N DWE	LLING.	n.s.w.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTI
1					1.410	1.345	1.520	1.568	1.340	1.459	1.277	1.412	1.421
$\overset{1}{2}$	• •	• •	••	• •	1.321	1.251	$\begin{vmatrix} 1.320 \\ 1.397 \end{vmatrix}$	1.448	1.239	1.456	1.136	1.100	1.326
3	• •	• •	• •	• •	1.321 $1.212$	1.231 $1.177$	$1.397 \ 1.250$	1.448 $1.270$	$\begin{array}{c c} 1.239 \\ 1.152 \end{array}$	1.430 $1.320$	$1.130 \ 1.201$	1.439	1.320
	• •	• •	• •		1.082	1.177 $1.051$	$\begin{bmatrix} 1.250 \\ 1.107 \end{bmatrix}$		$\begin{vmatrix} 1.152 \\ 1.059 \end{vmatrix}$	1.320 $1.148$	1.009	.938	1.079
4 5		• •			.977		.973	$1.102 \\ .964$	969	.991	.858	.944	.963
	• •	• •	• •	• •		.938					.898	1.024	.883
$\frac{6}{7}$ .	• •	• •	• •	• •	.907	.848	.893	.888	.893	.898			
	• •	• • •	• •		.823	.770	.827	.801	.817	.797	.736	.910	802
8		• •	• •	• •	.756	.707	.773	.747	.767	.720	.792	.787	.739
9	• •	• •	• •	• •	.702	.652	.722	.687	.717	.659	1.667	.492	.685
10	• • *	• •		٠.	.659	.608	.688	.622	.679	.609	.400	.688	.642
11					.619	.575	.655	.602	.625	.556	••	.545	.606
12					.601	.549	.659	.554	.595	.538		.542	.585
13					.586	.523	.587	.539	.596	.506			.558
14					.556	.506	.607	.499	.547	.495		.750	.538
15					.552	.498	.701	.442	.625	.464			.542
16					.503	.469	.673	.443	.571	.493		.813	.511
17					.535	.478	.542	.416	.615	.377			.502
18					.507	.486	.664	.373	.603	.415		١	.50
19					.512	.489	.611	.596	.456	.338	••	.211	.510
	nd over				.546	.465	1.012	.398		.357	••	.517	.554
All N	Private I Io. of Ro	Owellin oms wa	ngs for v as Spec	which ified	.928	.872	.948	.950	1.004	.961	1.098	913	.920

The average number of inmates per room in private dwellings decreases in each of the States with a fair degree of regularity as the number of rooms increases, and for the Common-

## Average Number of Inmates per Room, Private Dwellings, Commonwealth, 1911.



GRAPH No. 158.

wealth as a whole varies between the limits of 1.4 persons per room for private dwellings of one room, and .5 persons per room for private dwellings of 17 or more rooms. Somewhat similar limits of variation are in evidence for each of the States.

Graph No. 158 furnishes a representation of the average number of inmates per room for private dwellings of different sizes. The figures at the feet of the pillars denote the number of rooms contained in the dwellings, while the scale on the left denotes the average number of inmates per room in such dwellings. The pillar marked "A.P.D." represents the average number of inmates per room for private dwellings of all sizes combined.

7. Materials of outer walls. (i.) Private dwellings.—A classification of occupied private dwellings according to the materials of which the outer walls were built, is furnished in the next table:—

#### Occupied Private Dwellings, Classified according to Materials of Outer Walls. 1911.

MATERIALS OF WHICH OUTER			S	TATES.			TERRIT		
WALLS WERE BUILT.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	<b>F.T.</b>	C'WLTH

#### NUMBER OF DWELLINGS.

Stone			9,020	5,905	242	51,052	4,063	1.575	38	30	71,925
Dalala	. `		114,679	69,537		13,388	14.854	6,787	ŭ	31	221,478
		• •	865	555		1,951	84	78	5	3	3,580
Concrete	• •	• •							- 4		
Iron			8,851	2,619	9,969	5,367	10,109	475	506	12	37,908
Wood	• •		162,493	175,122	95,348	7,073	20,611	28,948	188	183	489,966
Sun-dried Bricks	٠		1,875	2,203	36	636	1,530	10	2	3	6,295
Pisé			1,741	54	50	46	17	3		29	1,940
Lath and Plaster			791	619	12	88	86	44			1,640
Wattle and Dab			744	335	2	210	,58	** *			1,349
Bark			1,290	671	1,149	2	52	22	175	2	3,363
Bushes, Rushes, Spinn	ifex,	etc.	15	7	266	9	390	2	178		867
Calico, Canvas, Hessi	an		15,706	4,762	11,692	1,875	14,216	621	93	133	49,098
Ruberoid & other Con	nposit	ions	130	41	81	23	56	6			337
Unspecified	٠.,	• •	1,566	1,204	663	388	427	379	11	5	4,643
TOTAL			319,766	263,634	121,753	82,108	66,553	38,950	1,194	431	894,389
			I			1		I.			

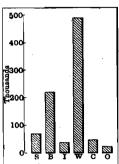
## PERCENTAGE ON TOTAL SPECIFIED.

	%	%	%	%	.%	%	%	%	%
Stone	2.83	2.25	.20	62.47	6.14	4.08	3.21	7.04	8.08
Brick	36.04	26.50	1.82	16.38	22.46	17.60	.09	7.28	24.89
Concrete	.27	.21	.03	2.39	.13	.20	.17	.70	.40
Iron	2.78	1.00	8.23	6.57	15.29	1.23	42.77	2.82	4.26
Wood	51.07	66.73	78.74	8.66	31.17	75.05	15.89	42.96	55.07
Sun-dried Bricks	.59	.84	.03	.78	2.31	.03	.17	.70	.71
Pisé	.55	.02	.04	.06	.03	.01		6.81	.22
Lath and Plaster	.25	.24	.01	.11	.13	.11		٠	.18
Wattle and Dab	.23	.13	.00	.26	.09				.15
Bark	.41	.26	.95	.00	.08	.06	14.79	.47	.38
Bushes, Rushes, Spinnifex, etc.	.00	.00	.22	.01	.59	.01	15.05	* *	.10
Calico, Canvas, Hessian	4.94	1.81	9.66	2.29	21.50	1.61	7.86	31.22	5.52
Ruberoid & other Compositions	.04	.01	.07	.02	.08	.01	••	• •	.04
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

In all the States except South Australia wooden private dwellings were more numerous than those constructed of any other material specified, and in all except South Australia and

Western Australia, wooden private dwellings represented more than 50 per cent. of the total private dwellings. In South Australia no less than 62½ per cent. of the private dwellings were built of stone, while in Western Australia dwellings of iron, and of calico, canvas or hessian were very numerous. Brick occupied second place in all the States except Queensland, where "canvas, calico, hessian" ranked second. As indicated above, stone was proportionately more largely employed for private dwellings in South Australia than in any other State. Similarly brick was proportionately preponderant in New South Wales, wood in Queensland, iron and also calico, canvas or hessian in Western Australia. The other materials were proportionately unimportant in any of the States, and represented in combination less than 2½ per cent. of the total.

Materials of Occupied Private Dwellings, Commonwealth, 1911.



GRAPH No. 159.

A representation of the number of occupied private dwelling of each class of material is furnished in Graph No. 159 for the Commonwealth as a whole. The letters at the feet of the several pillars have the following significance:—S, stone; B, brick; I, iron; W, wood; C, coling converse beggins of the materials. The goals on the left of

the following significance:—S, stone; B, brick; I, iron; W, wood; C, calico, canvas, hessian; O, other materials. The scale on the left of the graph indicates the number of thousands of dwellings of each class of material.

(ii.) Dwellings other than private.—The succeeding table furnishes a similar classification in respect of occupied dwellings other than private:—

Occupied Dwellings other than Private, Classified according to Materials of Outer Walls. 1911.

MATERIALS OF WHICH OUTER		×	S	STATES.			TERRI	rories.	
WALLS WERE BUILT.	N.S.W.	Vie,	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth

## NUMBER OF DWELLINGS.

	•								
Stone	960	664	56	1,548	255	149	6	2	3,640
Briok	6,462	5,064	621	304	1,078	452		1	13,982
Concrete	42	42	8	8	2	11			113
Iron	152	43	263	61	332	15	22	1	889
Wood	3,022	2,937	2,798	74	422	427	3	4	9,687
Sun dried Brieke	7	5	i . i	3	24				40
Pisé	22		11	١ ٔ	•				33
Lath and Plaster	4	12		1		1			18
Wattle and Dab	3		•.•	1					4
Rorle	8		1	١					9
Bushes, Rushes, Spinnifex, etc.			4				1	•,•	. 5,
Calico, Canvas, Hessian	156	8	18	3	89			. 3	277
Ruberoid & other Compositions	3 2	1			3				6
II namani Gad	99	127	81	32	17	10	1	• • •	367
Wagons, Trains, etc	250	145	171	18	15	10			609
Aboriginal Camps in which Whi	tes								
or Half-castes were Living		. 1	50	18	80	• • .	21		191
TOTAL	11,210	9,049	4,083	2,071	2,317	1,075	54	11	29,870
		1							[

## PERCENTAGE ON TOTAL SPECIFIED.

				1	Ι.	1	1	i		Ĭ .	<u> </u>
			%	_%	%_	. %	_ % .	%	%	%	%
Stone			8.86	7.57	1.48	77.28	11.56	14.12	% 18.75	18.18	12.68
Brick		.'.	59.61	57.70	16.42	15.18	48.89	42.84	,	9.09	48.71
Concrete ,.			.39	.48	.21	.40	.09	1.04			.39
Iron			1.40	.49	6.96	3.05	15.06	1.42	68.75	9.09	3.10
$\mathbf{Wood}$			27.88	33.46	74.00	3.69	19.14	40.48	9.38	36.37	33.75
Sun-dried Bricks			.06	.06	.03	.15	1.09		• • •		.14
Pisé			.20		.29			• •			.12
Lath and Plaster			.04	.14		.05	,	.10			.06
Wattle and Dab			.03			.05				• •	.01
Bark			.07		.03			• •		• •	.03
Bushes, Rushes, Spin		etc.			.11				3.12		.02
Calico, Canvas, Hes	sian		1.44	.09	.47	,15	4.04			27.27	.97
Ruberoid & other Co	ompositi	ions	.02	.01			.13		• •		.02
TOTAL	٠	••	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
									1	1	<u> </u>

Brick, wood and stone in the order named, were the materials most largely used in the construction of non-private dwellings, these three materials accounting between them for upwards of 95 per cent. of the total number of dwellings of this class. Amongst the States, brick occupied first and wood second place in New South Wales, Victoria, Western Australia and Tasmania; wood first and brick second in Queensland; with stone first and brick second in South Australia.

(iii.) All dwellings.—The following table furnishes particulars for all occupied dwellings (private and other), classified according to materials of outer walls, for the Commonwealth and the several States and Territories:—

# Occupied Dwellings (Private and Other), Classified according to Materials of Outer Walls. 1911.

MATERIALS OF WHICH OUTER			S	rates.			TERRE	rories.	
WALLS WERE BUILT.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth
	<u>'</u>								

#### NUMBER OF DWELLINGS.

,		`								
Stone	• • • •				52,600	4,318		44	32	
Brick		.   121,141	74,601	2,822	13,692	15,932	7,239	1	32	235,460
Concrete		. 907	597	50	1.959	86	89	2	3	3,693
Iron		. 9,003	2,662	10,232	5,428	10,441	490	528	13	38,797
Wood		. 165,515	178,059	98,146	7,147	21,033	29,375	191	187	499,653
Sun-dried Bricks		. 1,882	2,208	37	639	1,554	10	2	3	6,335
Pisé		1,763			46	17	3		29	1,973
Lath and Plaster		. 795	631	12	89	86	45			1,658
Wattle and Dab		. 747	335	2	211	58				1,353
Bark		. 1,298	671	1,150	2	52	22	175	2	3,372
Bushes, Rushes, Spin	mifex, etc.	15	7	270	9	390	2	179		872
Calico, Canvas, Hess	sian .	. 15,862	4,770	11,710	1.878	14,305	621	93	136	49,375
Ruberoid & other Co	mpositions	132	42		23	59	. 6			343
Unspecified	·	. 1,665	1,331	744	420	444		12	5	5,010
Wagons, Trains, etc.		. 250			18	15	10			609
Aboriginal Camps in	which Whit	es								
or Half-castes we			1	50	18	80		21		191
			·							
Total		. 330,976	272,683	125,836	84,179	68,870	40,025	1,248	442	924,259
			[	'			, ,			

## PERCENTAGE ON TOTAL SPECIFIED.

					_		l	l	l	l	l		l
Stone					3.03	$^{\%}_{2.42}$	.24	62.83	6.32	$\begin{array}{c} \% \\ 4.35 \end{array}$	% 3.62	$\begin{array}{c} \% \\ 7.32 \end{array}$	8.23
Brick	• •	• •	• •	• •	36.82	27.51	2.26	16.35	23.32	18.27	.08	7.32	25.64
Concrete	• •	• •	• •	٠.	.28	.22		2.34	.13	.22	.16	.69	.40
Iron	• •	• •	• •	• •	2.74	.98	.04 8.19	6.48	15.28	1.24	43.46	2.97	4.22
Wood	• •	• •	• •	• •	50.30	65.66	78.60	8.54	30.78	74.13	15.72	42.79	54.40
Sun-dried	Raiol		• •	• •	.57	.81		.76	2.27	.02	.16	.69	
Pisé		78	• •	• •		.02	.03			_		6.64	.69
Lath and	Dlant		• •	• •	.54		.05	.06	.02	.01	••	0.04	
			• •	• •	.24	.23	.01	.11	.13	.11			.18
Wattle a	na Da	D	• •	• •	.23	.12	.00	.25	.08	• • •		1	.15
Bark		. · ·		. • •	.39	.25	.92	.00	.08	.05	14.41	.46	.37
Bushes, F				te.	.00	.00	.22	.01	.57	.01	14.73		.09
Calico, C					4.82	1.76	9.38	2.24	20.93	1.57	7.66	31.12	5.38
Ruberoid	& oth	er Co	mpositi	ons	.04	.02	.06	.03	.09	.02	• •		.04
To	TAL	••			100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100,00

Briefly stated the proportions for the Commonwealth for all occupied dwellings were as follows:—

Particulars.	Wood.	Brick.	Stone.	Calico, Canvas, Hessian.	Iron.	All other Materials	Total.
Percentage of total occupied dwellings	% 54.40	% 25.64	% 8.23	% 5.38	% 4.22	% 2.13	100.00

(iv.) Innates of private dwellings.—In the next table is given the number of innates of each class of occupied private dwelling, the classification being based upon the materials of which the outer walls were built:—

## Inmates of Occupied Private Dwellings, Classified according to Materials of Outer Walls of Dwellings, 1911.

MATERIALS OF WHICH OUTER			s	TATES.			TERRIT	ORIES.	
WALLS WERE BUILT.	n.s.w.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH

#### NUMBER OF INMATES.

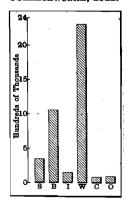
#·*			`					_					
Stone					46,213	29,707	1,370	246,399	19,963	7,987	174	146	351,959
Brick					557,993	328,362	10,491	60,151	68,521	32,388	6	205	1,058,117
Concrete					4,431	2,840	209	9.154	399	365	11	8	17,417
Iron					37,013	11,002	41,949	23,113	36,319	1,687	1,380	72	152,535
Wood					783,484	806,687	464,577	31,586	82,124	133,496	428	885	2,303,267
Sun-dried	Brick	KS.			9,360	10,593	183	2,769	7,424	41	10	6	30,386
Pisé					10,023		361	165	65	15		133	11,072
Lath and	Plast	er			3,835		67	384	372	213			7,568
Wattle an	nd Da	b			3,391	1,341	8	819	258				5,817
Bark					3,317	1,565	2,761	2	127	40	227	9	8,048
Bushes, F	ushes	, Spin	nifex, e	tc.	48	8	744	30	605	2	295		1,732
Calico, Ca	anvas.	Hess	ian		28,562	7,842	20,294	3,319	27,368	942	121	. 178	88,626
Ruberoid	& oth	ier Co	mpositi	ons	516	132	294	109	204				1,277
Unspecific	$_{ m ed}$		٠	• •	6,318	4,630	2,506	1,622	1,411	1,577	30	11	18,105
To	TAL				1,494,504	1,207,716	545,814	379,622	245,160	178,775	2,682	1,653	4,055,926

#### PERCENTAGE ON TOTAL SPECIFIED.

	%	%	% .25	. %	%	%	%	%	%
Stone	 3.11	2.47	.25	65.18	8.19	4.51	6.56	8.89	8.72
Brick	 37.49	27.29	1.93	15.91	28.11	18.28	.23	12.48	26.21
Concrete	 .30	.24	.04	2.42	.16	.21	.41	.49	.43
Iron	 2.49	.91	7.72	6.12	14.90	.95	52.04	4.38	3.78
Wood	 52.65	67.05	85.51	8.36	33.69	75.34	16.14	53.90	57.04
Sun-dried Bricks	 .63	.88	.03	.73	3.05	02	.38	.37	.75
Pisé	 .67	.03	.07	.04	.03	.01	l	8.10	.27
Lath and Plaster	 .26	.23	.01	.10	.15	.12			.19
Wattle and Dab	 .23	.11	.00	.22	.11		١		.14
Bark	 .22	.13	.51	.00	.05	.02	8.56	.55	.20
Bushes, Rushes, Spinn	.00	.00	.14	.01	.25	.00	11.12	1	.04
Calico, Canvas, Hessia	1.92	.65	3.74	.88	11.23	.53	4.56	10.84	2.20
Ruberoid & other Con	.03	.01	.05	.03	.08	.01		•••	.03
TOTAL	 100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	 1	I	I	1		<u> </u>	J	<u> </u>	<u> </u>

Two interesting features of the above table are (i.) the large proportion of the Queensland population who lived in wooden houses, and (ii.) the large proportion of the South Australian population who lived in houses built of stone.

Inmates of Private Dwellings, Commonwealth, 1911.



GRAPH No. 160.

The accompanying Graph (No. 160) furnishes a representation of the number of inmates of private dwellings, the outer walls of which were built of the materials specified. The letters at the feet of the several pillars have the following significance:—S, stone; B, brick; I, iron; W, wood; C, calico, canvas, hessian; O, other materials. The scale on the left of the graph indicates the number of hundreds of thousands of inmates resident in dwellings of the several classes of material indicated.

Taking the leading materials separately for the States, the inmates of stone private dwellings were proportionately most numerous in South Australia, and least numerous in Queensland. The inmates of brick private dwellings were proportionately most numerous in New South Wales and least numerous in Queensland. The inmates of iron private dwellings were proportionately most numerous in Western Australia and least numerous in Victoria. The inmates of wooden private dwellings were proportionately most numerous in Queensland and least numerous. The inmates of capyas calico and bessian private dwellings were

in South Australia. The inmates of canvas, calico and hessian private dwellings were proportionately most numerous in Western Australia and least numerous in Tasmania.

(v.) Inmates of dwellings other than private.—Corresponding particulars for the inmates of dwellings other than private is furnished in the following table:—

Inmates of Dwellings other than Private, Classified according to Materials of Outer Walls of Dwellings. 1911.

Materials of which Outer			S	TATES.		'	TERRIT	ORIES.	•
WALLS WERE BUILT.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	С'уктн
· · · · · · · · · · · · · · · · · · ·	,	NUMBE	ER OF I	NMATE	es.				ı
Stone	18,992	9,597	817	18,281	4.581	1,401	63	12	53,744
D ! 1	00 171	63,111	13,675	5,409	14,976	6,011		9	183,342
a .	900	418	180	85	60	131		-	1,27(
	1 = 00	354	2,205	514	2,557	146	133	.4	7,67
		24.452		673	3,837	3,833	7	20	101.57
Wood	1 ' 00		35,169			'	.,	• -	36
Sun-dried Bricks		84	15	19	175		• • •	• • •	390
Pisé			127		• •	·· <sub>7</sub>	• •	• • •	
Lath and Plaster		39		6		· ·	• •	• •	9:
Wattle and Dab		• • •	· · · _	4	••	• •		• •	2'
Bark	. 74	• • •	2			• •	.:.	• • •	7
Bushes, Rushes, Spinnifex, etc.	::	•:-	69	·:_	1 ::	• • •	12	• • •	8
Calico, Canvas, Hessian		51	294	25	425		'	10	1,77
Ruberoid & other Compositions	28	7			16		• •		5
Unspecified		2,899	576	361	914	140	4	• •	7,38
Wagons, Trains, etc	. 1,160	287	354	35	21	19		• •	1,87
Aboriginal Camps in which Whit									
or Half-castes were Living.	. 151	1	220	94	205		47	• • •	71:
TOTAL	. 140,149	101,300	53,703	25,506	27,767	11,688	266	55	360,43
	PERCE	NTAGE	ON TO	TAL S	PECIFII	ED.			
		ĺ	1	Ī					<u> </u>
_	%	%	.%	%	% 17.20	1,%	20%	2,%	1.%
Stone		9.78	1.56	73.08		12.15	29.30	21.82	15.34
Brick		64.32	26.02	21.62	56.24	52.14	٠	16.36	52.31
Concrete		.43	.34	.34	.23	1.14		-::-	.36
Iron		.36	4.20	2.05	9.60	1.27	61.86	7.27	2.19
Wood		24.92	66.92	2.69	14.41	33.24	3.26	36.37	28.98
Sun-dried Bricks		.09	.03	.08	.66	• •	• •	• • •	.10
Pisé	19		.24				• •	• •	.11
Lath and Plaster		.04		.02		.06	• •		.03
Wattle and Dab				.02		• •			.01
Bark	06		.00						.02
Bushes, Rushes, Spinnifex, etc.			.13				5.58		.02
Calico, Canvas, Hessian .		.05	.56	.10	1.60			18.18	.51
Ruberoid & other Compositions	.02	.01	• •	• • •	.06		• •	• • •	.02
TOTAL	. 100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

In this case also the preponderance of wood in the case of Queensland, and of stone in the case of South Australia are in evidence.

(vi.) Inmates of all dwellings.—The succeeding table furnishes a classification of the population resident in all dwellings according to the materials of which the outer walls of the dwellings were built:—

Inmates of All Dwellings (Private and Other). 1911.

TERRITORIES. STATES. MATERIALS OF WHICH OUTER C'wlth WALLS WERE BUILT. F.T. N.S.W. Vic. W.A. Tas. N.T. Q'land. S.A. NUMBER OF INMATES. 158 405,703 65,205 39,304 2,187 264,680 24,544 9,388 237 Stone 65,560 9,239 23,627214 1,241,459 8 18,687 638,144391,473 24,166 83,497 38,399 Brick  $\frac{4,827}{38,776}$ 11 3,258 389 459 496 Concrete 76 160,211 38,876 1,833 11,356 44,154 1,513 Iron 32,259 2,788905 2,404,844 6 30,748 817,070 831,139 499,746 85,961 ,329 435 Wood . . 9,429 10,28610,677 310 41 198 10 Sun-dried Bricks 7,599 165 65 133 11,462 488 Pisé . . Lath and Plaster 3,875 2,736 67 390 372220 7.660 . . 823 258 Wattle and Dab 3.414 1,341 227 3,391 127 9 8,124 2,763 1,565 Bark Bushes, Rushes, Spinnifex, etc. Calico, Canvas, Hessian 48 813 30 605 307 1.813 121 3,344  $94\bar{2}$ 188 29,527 7,893  $20,588 \\ 294$ 27.79390.396 220544 139 109  $\overline{22}$ 1,328 Ruberoid & other Compositions Wagons, Trains, etc.

Aboriginal Camps in which Whites
or Half-castes were Living... 2,325 21 34 11 25,487 8,806 7,529 3,082 1,983 1,717 1,876 354 1.160 287 35 19 . . 718 47 151 220 94 205 1,708 4,416,360 TOTAL INMATES OF DWELLINGS | 1634653 | 1309016 | 599,517 | 405,128 | 272,927 | 190,463

In mates of All Dwellings (Private and Other), 1911—continued.

Materials of which Ou	TER	STATES. TER								
WALLS WERE BUILT.		N.S.W.	Vic.	Q'land.	S.A.	w.a.	Tas.	N.T.	F.T.	C'WLTE
	F	ERCEN	TAGE (	ON TOT	AL SPE	CIFIED	).			
Stone		4.01	3.02	.37	65.68	9.08	4.97	8.27	9.31	9.25
Brick		39.28	30.09	4.06	16.27	30.88	20.35	.21	12.61	28.29
Concrete		.30	.25	.07	2.29	.17	.26	.38	.47	.43
Iron		2.39	.87	7.41	5.86	14.38	.97	52.77	4.48	3.65
Wood		50.30	63.88	83.87	8.00	31.79	72.77	15.17	53.33	54.80
Sun-dried Bricks		.58	.82	.03	.69	2.81	.02	.35	.35	.70
Pisé		.63	.02	.08	.04	.02	.01	• • •	7.84	.26
Lath and Plaster		.24	.21	.01	.10	.14	.12	• • •		.17
Wattle and Dab		.21	.10	.00	.20	.10				.13
Bark		.21	.12	.46	.00	.05	.02	7.92	.53	.19
Bushes, Rushes, Spinnifex,	etc.	.00	.00	.14	.01	.22	.00	10.71		.04
Calico, Canvas, Hessian		1.82	.61	3.45	.83	10.28	.50	4.22	11.08	2.06
Ruberoid & other Composi	tions	.03	.01	.05	.03	.08	.01	• •	• •	.03
TOTAL		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The proportionate distribution of Commonwealth occupants of dwellings of all kinds may be summarised as follows in respect of the materials of which the outer walls of their dwellings were built :—

Particulars.	Wood.	Brick.	Stone.	Iron.	Calico, Canvas, Hessian.	All other Materials	Total.
Percentage of total inmates	% 54.80	28.29	9.25	% 3.65	2.06	% 1.95	100.00

(vii.) Inmates per private dwelling.—The average number of inmates per occupied private dwelling of each class of material is shewn in the following table for the Commonwealth and each State and Territory:—

Average Number of Inmates per Private Dwelling, 1911.

MATERIALS OF WHICH OUTER			3.	PATES.			IERRI	ORIES.	
WALLS WERE BUILT.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'WLTH
Stone	. 5.12	5.03	5.66	4.83	4.91	5.07	4.58	4.87	4.89
Brick	. 4.87	4.72	4.77	4.49	4.61	4.77	6.00	6.61	4.78
Concrete	. 5.12	5.12	4 97	4.69	4 75	4.68	5.50	2.67	4.87
Iron	. 4.18	4.20	4.21	4.31	3.59	3.55	2.73	6.00	4.02
Wood	. 4.82	4.61	4.87	4.47	3.98	4.61	2.28	4.84	4.70
Sun-dried Bricks	. 4.99	4.81	5.08	4.35	4.85	4.10	5.00	2.00	4.83
Pisé	. 5.76	5.74	7.22	3.59	3.82	5.00		4.59	5.70
Lath and Plaster	. 4.85	4.36	5.58	4.36	4.33	4.84			4.61
Wattle and Dab	. 4.56	4.00	4.00	3.90	4.45				4.31
Bark	. 2.57	2.33	2.40	1.00	2.44	1.82	1.30	4.50	2.39
Bushes, Rushes, Spinnifex, etc.	3.20	1.14	2.80	3.33	1.55	1.00	1.66		2.00
Caliar Common Hosgian	. 1.82	1 65	1:74	1 77	1.93	1.52	1.30	1.34	1.80

3.63

4.48

3.97

4.03

4.67

3.22

3.85

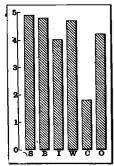
4.58

Average Number of Inmates per Private Dwelling, Commonwealth, 1911.

Unspecified

Ruberoid & other Compositions

ALL CLASSES OF MATERIAL..



GRAPH No. 161.

Dealing with the materials most largely used, stone private dwellings for the Commonwealth as a whole contained 4.89 inmates per dwelling, while those built of brick averaged 4.78, of wood 4.70, of iron 4.02, and of calico, canvas or hessian only 1.80. In all the States except Queensland the same relative order was maintained in respect of the materials specified, wood taking precedence of brick in the case of Queensland.

4.62

3.67

3.90

4.59

2.73

2.25

2.20

3.84

3.64

3.30

3.68

3.79

3.90

4.53

A representation of the average number of inmates per private dwelling is furnished in Graph No. 161 for various classes of materials, the particulars given relating to the Commonwealth as a whole. The letters at the feet of the pillars have the following significance:—S, stone; B, brick; I, iron; W, wood; C, calico, canvas, hessian; O, other materials. The scale on the left indicates the number of inmates per dwelling for each class of material indicated.

(viii.) Number of rooms.—Full details for the Commonwealth and each State and Territory in respect of materials and number of rooms taken in combination are contained in Vol. III., pp. 1870 to 1885. A brief summary for the Commonwealth as a whole is given in the following table:—

No. of Dwellings according to Materials and Rooms. Commonwealth, 1911.

Number	of	Rooms.		Wood.	Brick.	Stone.	Calico, Canvas, Hessian.	Iron.	All other Materials	Unspeci- fied.	Total.
				-	PRIVATI	DWEL	LINGS.		1		<u> </u>
1 to 3				79,282	21,272	10,275	46,900	17,302	7,351	922	183,304
4 to 6				327,557	141,243	44,163	2,114	18,784	9,843	707	544,411
7 to 9				72,009	46,483	13,435	41	1,519	1,791	105	135,383
10 and over				10,591	12,154	3,959	6	253	367	28	27,358
Unspecified				527	326	93	37	50	19	2,881	3,933
TOTAL				489,966	221,478	71,925	49,098	37,908	19,371	4,643	894,389
				DWEL	LINGS O	THER T	HAN PR	IVATE.	<u>'</u>	,	·
1 to 3				246	286	82	171	93	10	13	901
4 to 6				1,995	2,399	588	79	214	55	13	5,343
7 to 9				2,275	3,649	793	13	188	50	19	6,987
10 and over				5,104	7,452	2,129	11	383	112	29	15,220
Unspecified		• •		67	196	48	3	11	1	1,093	1,419
TOTAL		• •	• •	9,687	13,982	3,640	277	889	228	1,167	29,870
				1	ALL	DWELL	INGS.				
1 to 3				79,528	21,558	10,357	47,071	17,395	7,361	935	184,205
4 to 6		• • •	• •	329,552	143,642	44,751	2,193	18,998	9,898	720	549,754
7 to 9		::	• • •	74,284	50,132	14,228	54	1707	1,841	124	142,370
10 1		• • •	• • •	15,695	19,606	6,088	17	636	479	57	42,578
Unspecified	• •		• • •	594	522	141	40	61	20	3,974	5,352
TOTAL				499,653	235,460	75,565	49,375	38,797	19,599	5,810	924,259

It will be seen that for each of the various kinds of material specified, with the exception of "calico, canvas, hessian," the number of dwellings of 4 to 6 rooms was greater than for any other of the room groups shewn. In the case of wooden dwellings, those containing 4 to 6 rooms comprised 66 per cent. of the total wooden dwellings, the corresponding percentages in the case of the other materials for dwellings of 4 to 6 rooms being as follows:—Brick, 61 per cent.; stone, 59 per cent.; calico, canvas, hessian,  $4\frac{1}{2}$  per cent.; iron, 50 per cent.; and "all the other materials," 51 per cent. In the case of calico, canvas and hessian dwellings more than 95 per cent. contained less than 4 rooms.

(ix.) Number of inmates.—Particulars in respect of the numbers of dwellings of each class of material containing inmates ranging in number from 1 to 20 and over is given for the Commonwealth, and for each State and Territory in Vol. III., pp. 1886 to 1901. A summary for the Commonwealth as a whole is contained in the following table:—

No. of Dwellings according to Materials and Inmates. Commonwealth, 1911.

Number	of	Inmates.		Wood.	Brick.	Stone.	Calico, Canvas, Hessian.	Iron.	All other Materials	Unspeci- fied.	Total.
			_		PRIVA	TE DWE	LLINGS.				-
1 to 3				176,624	73,557	23,769	43,869	18,659	8,842	2,482	347,802
4 to 6				204,104	101,146	31,188	4,093	13,041	6,374	1,378	361,324
7 to 9				87,356	38,155	13,304	948	4,946	3,147	586	148,442
10 and over	• •	• •	• •	21,882	8,620	3,664	188	1,262	1,008	197	36,821
TOTAL		• •		489,966	221,478	71,925	49,098	37,908	19,371	4,643	894,389
				DWEL	LINGS C	THER 1	THAN PR	LIVATE.			<u> </u>
1 to 3				1,070	1,162	347	77	226	44	791	3,717
4 to 6		• •		2,437	3,096	748	106	242	49	146	6,824
7 to 9			• •	2,328	3,415	828	63	157	44	77	6.912
10 and over		• •		3,852	6,309	1,717	31	264	91	153	12,417
TOTAL				9,687	13,982	3,640	277	889	228	1,167	29,870
				_	ALL D	WELLIN	īGS.		·		
1 to 3				177,694	74,719	24,116	43,946	18,885	8,886	3,273	351.519
4 to 6				206,541	104,242	31,936	4,199	13,283	6,423	1,524	368,148
7 to 9		• •		89,684	41,570	14,132	1,011	5,103	3,191	663	155,354
10 and over		• •		25,734	14,929	5,381	219	1,526	1,099	350	49,238
TOTAL				499,653	235,460	75,565	49,375	38,797	19,599	5,810	924,259

Of the inmate groups specified in the above table, dwellings, of which the outer walls were built of wood, brick or stone, were most numerously represented in the group of 4 to 6 inmates; while dwellings of the other materials shewn were most numerous in the 1 to 3 inmates group. For all classes of materials the number of dwellings containing 4 to 6 inmates was about 5 per cent. more than the number containing 1 to 3 inmates, while these groups together accounted for 719,667 dwellings, or nearly 78 per cent. of the total.

8. Weekly rental values. (i.) Number of rooms.—Details concerning the weekly rental values of dwellings for the Commonwealth and the several States and Territories are furnished in Vol. III., pp. 1920 to 1961. The following table gives a brief summary of the number of houses of different sizes in certain rental value groups.

No. of Rooms and Weekly Rental Values. Commonwealth, 1911,

					No. of D	WELLINGS O	ONTAINING	- Rooms то ті	HE NO. OF	
WEEKLY	Danas	1				·			1,0,0,	(Danie
WEEKLY	RENT	AL	VALUE.		1 to 3	4 to 6.	7 to 9.	10 & over	Un- specified.	TOTAL
					PRIVAT	E DWELL	INGS.	,		
Jnder 5s.					63,051	50,176	2,536	102	87	115,95
5s. and under	· 10s.				48,761	199,978	21,463	1,254	180	271,63
0s. "	15s.				9,106	162,192	30,227	2,984	108	204,61
5s. ,,	20s.				825	45,944	21,521	2,293	50	70,63
0s. ,,	25s.		• •		315	16,284	19,899	3,885	38	40,42
58. ,,	30s.		• •	• •	57	3,903	10,677	2,507	11	17,15
0s. ,,	35s.				31	1,280	5,768	2,729	9	9,81
5s. "	40s.	٠.	· •		10	. 232	1,309	885	5	2,44
2 ,,	£3	• •			••	307	2,094	3,335	.13	5,74
3 ,,	£4			• •	• • •	35	229	1,112	5	1,38
4 ,,	£5			• •	• •		41	427	3	47
5 and over							26	481	3	510
Inspecified	• •	• •	• •	• •	61,148	64,080	19,593	5,364	3,421	153,60
TOTAN	• •	, • •	• •		183,304	544,411	135,383	27,358	3,933	894,38
			]	DWEI	LINGS OT	THER THA	N PRIVA	ГЕ.		
					- 		1	ŀ	1	1
						-01				1
		• •	• •	٠.	103	124	18	6	2	
5s. and under	· 10s.				131	959	385	140	4	1,61
5s. and under	10s. 15s.			• •	131 57	959 1,633	385 1,130	140 509	<b>4</b> 5	1,61 3,33
5s. and under 10s. ,,	10s. 15s. 20s.		•••	• • • • • • • • • • • • • • • • • • • •	131 57 13	959 1,633 1,136	385 1,130 1,448	140 509 670	4 5 3	1,619 3,33 3,276
5s. and under 10s. ,, 15s. ,, 20s. ,,	10s. 15s. 20s. 25s.	••	•••	· · · · · · · · · · · · · · · · · · ·	131 57 13 15	959 1,633 1,136 480	385 1,130 1,448 1,639	140 509 670 1,451	4 5 3 11	1,61 3,33 3,27 3,59
5s. and under 10s. ,, 15s. ,, 20s. ,, 25s. ,,	10s. 15s. 20s. 25s. 30s.	• • •			131 57 13 15 4	959 1,633 1,136 480 120	385 1,130 1,448 1,639 921	140 509 670 1,451 958	5 3 11 2	1,619 3,33 3,276 3,59 2,00
5s. and under 10s. ,, 15s. ,, 20s. ,, 30s. ,,	10s. 15s. 20s. 25s. 30s. 35s.				131 57 13 15	959 1,633 1,136 480 120 62	385 1,130 1,448 1,639 921 451	140 509 670 1,451 958 1,319	4 5 3 11 2 8	25: 1,61: 3,33: 3,27: 3,59: 2,00: 1,84:
5s. and under 10s. ,, 15s. ,, 20s. ,, 25s. ,, 35s. ,,	10s. 15s. 20s. 25s. 30s. 35s. 40s.				131 57 13 15 4	959 1,633 1,136 480 120 62 15	385 1,130 1,448 1,639 921 451 134	140 509 670 1,451 958 1,319 481	4 5 3 11 2 8 1	1,619 3,334 3,276 3,596 2,000 1,844 63
5s. and under 10s. ,, 15s. ,, 20s. ,, 25s. ,, 30s. ,, 35s, ,, £2 ,,	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3				131 57 13 15 4	959 1,633 1,136 480 120 62 15 38	385 1,130 1,448 1,639 921 451 134 239	140 509 670 1,451 958 1,319 481 2,532	4 5 3 11 2 8 1 10	1,619 3,333 3,276 3,596 2,000 1,844 632 2,819
5s. and under 10s. ,, 15s. ,, 20s. ,, 25s. ,, 36s. ,, 55s. ,, 52 ,, ,, 22 ,, ,, 23 ,, ,,	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4				131 57 13 15 4	959 1,633 1,136 480 120 62 15	385 1,130 1,448 1,639 921 451 134 239 80	140 509 670 1,451 958 1,319 481 2,532 1,792	4 5 3 11 2 8 1 10 12	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,88
5s. and under 10s, 15s, 20s, 25s, 30s, 35s, 22, 23, 24,	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3				131 57 13 15 4	959 1,633 1,136 480 120 62 15 38	385 1,130 1,448 1,639 921 451 134 239 80 36	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120	4 5 3 11 2 8 1 10 12 9	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,88 1,16
5s. and under 10s, 15s, 20s, 30s, 35s, 22, 23, 24, 25 and over	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4				131 57 13 15 4 2 	959 1,633 1,136 480 120 62 15 38 2	385 1,130 1,448 1,639 921 451 134 239 80 36 33	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541	4 5 3 11 2 8 1 10 12 9	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,88 1,16 2,60
5s. and under 10s, 15s, 20s, 30s, 35s, 22, 23, 24, 25 and over	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4				131 57 13 15 4 2	959 1,633 1,136 480 120 62 15 38	385 1,130 1,448 1,639 921 451 134 239 80 36	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120	4 5 3 11 2 8 1 10 12 9	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81
5s. and under 10s. ", 15s. ", 20s. ", 25s. ", 30s. ", 35s. ", 52 ", 53 ", 54 ", 55 and over Unspecified	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4				131 57 13 15 4 2 	959 1,633 1,136 480 120 62 15 38 2	385 1,130 1,448 1,639 921 451 134 239 80 36 33	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541	4 5 3 11 2 8 1 10 12 9	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,88 1,16 2,60
5s. and under 10s. ", 15s. ", 20s. ", 22s. ", 25s. ", 30s. ", 35s. ", 52 ", 53 ", 54 ", 55 and over Unspecified	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4				131 57 13 15 4 2    576	959 1,633 1,136 480 120 62 15 38 2 774	385 1,130 1,448 1,639 921 451 134 239 80 36 33 473	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541 1,701	4 5 3 11 2 8 1 10 12 9 29 1,323	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,88 1,16 2,60 4,84
5s. and under 10s. ", 5s. ", 20s. ", 20s. ", 35s. ", 22 ", 23 ", 24 ", 25 and over Unspecified  Total	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4				131 57 13 15 4 2   576 901	959 1,633 1,136 480 120 62 15 38 2 774 5,343	385 1,130 1,448 1,639 921 451 134 239 80 36 33 473 6,987	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541 1,701 15,220	4 5 3 11 2 8 1 10 12 9 29 1,323	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,88 1,16 2,60 4,84
5s. and under 0s. " 15s. " 20s. " 25s. " 30s. " 35s. " 22 " 3 " 4 " 5 and over Unspecified  Total	10s. 15s. 20s. 25s. 30s. 30s. 40s. £3 £4				131 57 13 15 4 2   576 901	959 1,633 1,136 480 120 62 15 38 2 774 5,343	385 1,130 1,448 1,639 921 451 134 239 80 36 33 473 6,987	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541 1,701 15,220	4 5 3 11 2 8 1 10 12 9 29 1,323	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,16 2,60 4,84 29,87
5s. and under 0s. " 5s. " 5s. " 0s. " 5s. " 25s. " 25s. " 24 " 5 and over Unspecified  Total  Juder 5s. 5s. and under	10s. 15s. 20s. 25s. 35s. 40s. £3 £4 £5				131 57 13 15 4 2   576 901 ALL 1	959 1,633 1,136 480 120 62 15 38 2 774 5,343  DWELLING	385 1,130 1,448 1,639 921 451 134 239 80 36 33 473 6,987	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541 1,701 15,220	4 5 3 11 2 8 1 10 12 9 29 1,323 1,419	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,16 2,60 4,84 29,87
5s. and under 0s. " 5s. " 5s. " 90s. " 5s. " 5s. " 5s. " 5s. " 75 and over Juspecified  Total  Juder 5s. 5s. and under 0s. "	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4 £5				131 57 13 15 4 2   576 901 ALL 1 63,154 48,892 9,163	959 1,633 1,136 480 120 62 15 38 2 774 5,343  DWELLING 50,300 200,937 163,825	385 1,130 1,448 1,639 921 451 134 239 80 36 33 473 6,987	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541 1,701 15,220 108 1,394 3,493	4 5 3 11 2 8 1 10 12 9 29 1,323 1,419	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,88 1,16 2,60 4,84 29,87 216,20 273,25 207,95
5s. and under 0s. " 5s. " 5s. " 6s. " 5s. " 6s. " 5s. " 6s. " 5s. " 7 5 and over Inspecified  Total  Juder 5s. 5s. and under 0s. " 5s. "	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4 £5				131 57 13 15 4 2   576 901 ALL 1 63,154 48,892 9,163 838	959 1,633 1,136 480 120 62 15 38 2 774 5,343  DWELLING 50,300 200,937 163,825 47,080	385 1,130 1,448 1,639 921 451 134 239 80 36 33 473 6,987	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541 1,701 15,220 108 1,394 3,493 2,963	4 5 3 11 2 8 1 10 12 9 29 1,323 1,419	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,16 2,60 4,84 29,87 116,20 273,25 207,95 73,90
5s. and under 0s. ,, 5s. ,, 5s. ,, 10s. ,, 15s. ,, 15s. ,, 22 ,, 3 ,, 4 ,, 5 and over Inspecified  Total  Juder 5s. 5s. and under 0s. ,, 5s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,, 10s. ,	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4 £5 10s. 15s. 20s. 25s. 25s.				131 57 13 15 4 2   576 901 ALL 1 63,154 48,892 9,163 838 330	959 1,633 1,136 480 120 62 15 38 2 774  5,343  DWELLING  50,300 200,937 163,825 47,080 16,764	385 1,130 1,448 1,639 921 451 134 239 80 36 33 473 6,987	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541 1,701 15,220 108 1,394 3,493 2,963 5,336	4 5 3 11 2 8 1 10 12 9 29 1,323 1,419	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,88 1,16 2,60 4,84 29,87 20,273,25 207,95 73,90 44,01
5s. and under 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 22 ,, 3 ,, 4 ,, 5 and over Juspecified  Total  Juder 5s. 5s. and under 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0	10s. 15s. 20s. 25s. 30s. 40s. £3 £4 £5 10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4 £5				131 57 13 15 4 2   576 901 ALL 1 63,154 48,892 9,163 838 330 61	959 1,633 1,136 480 120 62 15 38 2 774 5,343  DWELLING  50,300 200,937 163,825 47,080 16,764 4,023	385 1,130 1,448 1,639 921 451 134 239 80 36 33 473 6,987	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541 1,701 15,220 108 1,394 3,493 2,963 5,336 3,465	4 5 3 11 2 8 1 10 12 9 29 1,323 1,419	1,61 3,33 3,270 3,59 2,00 1,84 63 2,81 1,88 1,16 2,60 4,84 29,87 29,87 44,01 19,16
5s. and under 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 5s. ,, 2 ,, 3 ,, 4 ,, 5 and over Inspecified  Total  Juder 5s. 5s. and under 0s. ,, 5s. ,, 0s. ,, 5s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s. ,, 0s	10s. 15s. 20s. 25s. 30s. 35s. 40s. £3 £4 £5 10s. 15s. 20s. 25s. 30s. 35s. 35s.				131 57 13 15 4 2   576 901 ALL 1 63,154 48,892 9,163 838 330 61 33	959 1,633 1,136 480 120 62 15 38 2 774 5,343  DWELLING  50,300 200,937 163,825 47,080 16,764 4,023 1,342	385 1,130 1,448 1,639 921 451 134 239 80 36 33 473 6,987 38.	140 509 670 1,451 958 1,319 481 2,532 1,792 1,120 2,541 1,701 15,220 108 1,394 3,493 2,963 5,336 3,465 4,048	4 5 3 11 2 8 1 10 12 9 29 1,323 1,419	1,61 3,33 3,27 3,59 2,00 1,84 63 2,81 1,88 1,16 2,60 4,84 29,87 116,20 273,25 207,95 73,90 44,01 19,16
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Of the total of 924,259 dwellings recorded there were 765,806, or about 83 per cent., concerning which the rental values were specified. Of this specified number no fewer than 597,411, or about 78 per cent., belonged to the three rental value groups under 15 shillings per week, the predominating group being that from 5 to 10 shillings.

(ii.) States and Territories.—The succeeding table furnishes for certain groupings of weekly rental values the number of dwellings recorded in each State and Territory of the Commonwealth at the Census of 3rd April, 1911:—

## Number of Dwellings at Different Weekly Rental Values. 1911.

WEEKLY RENTAL		Number of Dwellings.								
VALUE.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	F.T.	C'wlth.	

#### PRIVATE DWELLINGS.

	1	1	1		1	1 1			
Under 5s	. 35,978	29,562	17.947	11.870	9.329	19,629	585	52	115,952
5s. and under 10s.	90.254	88.265	39,861	26,123	14,407	12,549	105	72	271,636
100 150	76,689	61,999	25,740	19,182	14,679	6.237	61	30	204,617
150 900	28.122	20,786	7,357	7,385	4,976	1,989	14	4	70,633
90-	16,040	11,193	4,362	4.481	3,277	1,050	12	6	40,421
959 309	7,372	4,980	1,558	1,757	1,154	328	3	3	17,155
20%	4,449	2,605	954	917	681	210		1	9,817
25- 40-	1,175		164	181	144	50			2,441
69 69	2,760	1.567	486	444	374	117		1	5,749
69 64	700	366	88	107	92	28			1,381
£4 " £5	242	124	31	44	24	6			471
CE and arran	944	196	26	32	12				510
TT	55,741	41,264	23,179	9,585	17,404	5,757	414	262	153,606
Total	319,766	263,634	121,753	82,108	66,553	38,950	1,194	431	894,389

#### DWELLINGS OTHER THAN PRIVATE.

		1							
Under 5s	89	41	41	32	17	31	1	1	253
5s. and under 10s.	537	461	217	141	127	132	4		1,619
100	1,214	1,161	446	225	162	120	3	3	3,334
150 900	1,376	1,119	337	174	157	106	1		3,270
96-	1,430	1,149	382	247	249	135	4		3,596
95a 20a	809	664	190	156	127	59			2.005
20- 25-	7 <b>2</b> 0	545	220	139	156	61	1		1,842
95- 400	271	189	51	44	53	23			631
co co	1.041	879	421	183	213	79	2	1	2,819
£2 ,, £3 £3 ., £4	721	586	285	123	100	68	3		1,886
	415	349	187	85	79	50	"	.,	1,165
	879	1	401	227	431	64	1		2,603
£5 and over		600	905	295	446	147	34	6	4,847
Unspecified	1,708	1,306	905	290	440	14,	0.		
Momer	11 910	0.040	4,083	2,071	2,317	1,075	54	11	29,870
Total	11,210	9,049	4,083	2,011	2,511	1,010	01		,

#### ALL DWELLINGS.

Under 5s		36,067	29,603	17.988	11,902	9.346	10,660	586	53	116,205
5s. and under	10s.	90,791	88.726	40,078	26,264	14.534	12,681	109	72	273,255
100	15s.	77,903	63,160	26,186	19,407	14,841	6,357	64	33	207,951
16-	20s.	29,498	21,905	7,694	7,559	5,133	2,095	15	4	73,903
20-	20s. $25s.$	17,470	12,342	4,744	$\frac{1,000}{4.728}$	3,526	1,185	16	6	44,017
20s. ,,		8,181	5,644	1,748	1.913	1,281	387	3	3	19,160
25s. ,,	30s.			1,174	1,056	837	271	ĭ	ĭ '	11,659
30s. ,,	35s.	5,169	3,150		$\begin{array}{c} 1,030 \\ 225 \end{array}$	197	73	^		3,072
35s. ,,	40s.	1,446	916	215	$\begin{array}{c} 225 \\ 627 \end{array}$	587	196	2	2	8,568
£2 ,,	£3	3,801	2,446	907		192	96	$\frac{5}{3}$	_	3,267
£3 ,,	£4	1,421	952	373	230		56	- 1	• •	1,636
£4 ,,	£5	657	473	218	129	103			• •	3,113
£5 and over		1,123	796	427	259	443	64	448	268	158,453
Unspecified		57,449	42,570	24,084	9,880	17,850	5,904	448	400	100,400
TOTAL		330,976	272,683	125,836	84,179	68,870	40,025	1,248	442	924,259

In each State and Territory except Western Australia and the Northern Territory the predominant rental value group was that of 5s. to 10s. In Western Australia the group of 10s. to 15s. was slightly in excess of that of 5s. to 10s., while in the Northern Territory the group under 5s. predominated.

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(iii.) Average rental per private dwelling.—The average weekly rental values for those cases in which the particulars were supplied, have been computed in respect of the different sizes of dwellings and are furnished in the following table for each State and Territory as well as for the Commonwealth as a whole:—

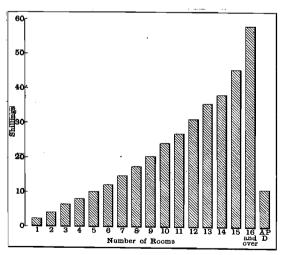
Average Weekly Rental Value of Occupied Private Dwellings.	3rd April, 1911.
------------------------------------------------------------	------------------

	No. of	Room	s.	N.S	.W.	v	ic.	Q'la	and.	s	.A.	W.	.A.	Т	ıs.	N.	Т.	F.	Т.	C'w	lth
				<i>s</i> .	d.	8.	d.	8.	d.	8.	d.	8.	d.	8.	d.	8.	d.	8.	d.	s.	d.
I				2	5	2	<b>2</b>	2	4	2	8	2	6	2	<b>2</b>	1	8	1	7	. 2	4
2				4	<b>2</b>	3	11	4	3	4	6	4	11	3	6	3	3	3	9	4	2
3				6	10	6	7	5	8	6	10	7	10	4	11	5	1	3	11	6	
4				8	4	7	10	7	3	8	2	9	11	6	4	7	11	5	0	8	
5				10	6	9	9	9	1	10	7	12	10	8	7	9	5	6	10	10	- 5
6				13	0	11	5	10	10	12	7	15	9	9	11	11	3	7	0	12	
7				16	2	13	11	13	2	15	5	19	8	12	3	16	-8	11	0	14	10
8				19	1	16	10	15	5	18	2	23	2	14	1	19	11	13	8	17	-
9				22	6	19	4	17	7	20	11	26	6	16	3	١.		9	6	20	
0				26	8	23	1.	20	9	24	11	29	1	19	5	17	6	23	8	24	
l				28	11	26	7	22	10	29	1	31	11	20	10			16	0	27	
2				34	4	30	3	25	10	$\overline{31}$	$\hat{3}$	34	2	22	9			١.		31	
3				39	$1\overline{0}$	34	6	30	ĭ	39	5	34	$\bar{2}$	22	4					35	
1 -				40	_6	38	9	31	9	41	2	42	4	$\overline{27}$	3					38	
5				47	ň	48	4	36	7	48	5	44	ō	33	$\ddot{2}$					45	
6 a	nd over	٠		60	0	64	6	41	7	58	10	70	3	28	4			10	6	58	-
11 <b>E</b>	Private I	Owelli	ngs	11	7	10	9	9	6	10	8	10	7	8	2	3	11	7	6	10	-

It will be seen that the average rental value for all private dwellings, in the cases of the Commonwealth as a whole, New South Wales, Victoria, Queensland and South Australia, fell between the averages for dwellings of 5 and those of 6 rooms, being nearer in each case to the 5 room average. In the cases of Western Australia and Tasmania the average for all fell between those for 4 and 5 rooms, being nearer the former in the case of Western Australia and nearer the latter in the case of Tasmania. The average for all dwellings in the Northern Territory was slightly in excess of that for 2 room dwellings, while that for the Federal Territory was slightly in excess of the average for 6 room dwellings. Owing to paucity of data the figures for the Territories are very irregular in comparison with those for the States.

This table furnishes striking evidence of the necessity for complete analysis of data, and the misapprehension that may arise in certain cases from the use of comprehensive averages.

Average Weekly Rental Value per Dwelling. Private Dwellings, Commonwealth, 1911.



GRAPH No. 162.

Thus the Commonwealth as a whole, Victoria, South Australia and Western Australia give averages for all dwellings, which are respectively 10s. 9d., 10s. 9d., 10s. 8d., and 10s. 7d. Notwithstanding this, it is clear from a consideration of the details that the rental values for dwellings of any given size above one room up to and including 12 room dwellings, are considerably higher in Western Australia, and lower in Victoria than in the other cases quoted. Taking dwellings of 4, 5 and 6 rooms the arrangement of the States in order of rental values from highest to lowest is as follows:—(1) Western Australia, (2) New South Wales, (3) South Australia, (4) Victoria, (5) Queensland, (6) Tasmania.

A representation of the average weekly rental value per dwelling of private dwellings of various sizes is furnished in the accompanying graph (No. 162) for the Commonwealth as a whole as at 3rd April, 1911. The figures shewn at the feet of the

pillars denote the number of rooms contained, while the scale on the left of the graph indicates the average weekly rental values in shillings of private dwellings of the several sizes indicated. The letters "A.P.D." at the foot of the final pillar signify "all private dwellings."

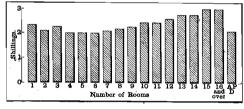
(iv.) Average rental per room.—The presentation of this information may be varied by computing the average weekly rental value per room. This has been done in the following table, which shews such details for the Commonwealth as a whole as well as for its component States and Territories:—

Average Weekly Rental Value per Room in Occupied Private Dwellings. 3rd April, 1911.

	No. of	Room	ıs.	N.S	s.w.	v	ic.	Q'la	and.	s	Α.	W.	A.	Τε	as.	N.	т.	F.	т.	C'w	lth.
1 2 3 4 5 6 7 8 9 10 11 12				s. 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	d. 5 1 3 1 1 2 4 5 6 8 8 10	s. 2 1 1 1 1 1 2 2 2 2 2 2 2	d. $2$ $11$ $2$ $11$ $11$ $11$ $11$ $2$ $4$ $5$ $6$	8. 2 2 1 1 1 1 1 1 2 2 2	d. 4 2 11 10 10 10 11 11 11 1 2	s. 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	d. 8 3 3 0 1 1 2 3 4 6 8 7	8. 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	d. $6$ $6$ $7$ $6$ $7$ $8$ $10$ $11$ $11$ $11$ $10$	s. 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	d. 2 9 8 7 9 8 9 9 10 11 11 11 11	s. 1 1 1 2 1 1 2 2 1 .	d. 8 7 8 0 11 10 5 6 .	8. 1 1 1 1 1 1 1 1 1 1 2	d. 7 11 4 3 4 2 7 8 1 4 5 5	s. 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	$egin{array}{ccccc} d. & 4 & 1 & 3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0$
13 14 15 16 a	  nd ove	· · · · · · · · · · · · · · · · · · ·	•••	3 2 3 3	$\begin{array}{c}1\\11\\2\\1\end{array}$	2 2 3 3	8 9 3 4	2 2 2 2	4 3 5 2	3 2 3 3	$\begin{matrix} 0 \\ 11 \\ 3 \\ 2 \end{matrix}$	2 3 2 3	$     \begin{array}{c}       8 \\       0 \\       11 \\       10     \end{array} $	1 1 2 1	$9 \\ 11 \\ 3 \\ 7$					2 2 3 3	9 0 0
All F	Private	Dwelli	ngs	2	3	2	0	1	10	2	2	2	7	1	8	1	9	1	5	2	1

The average rental per room for all private dwellings is a much better index to relative rental level than is the average per dwelling commented upon on p. 417. From the above table it will be seen that this average gives for the several States the same arrangement in order

Average Weekly Rental Value per Room, Private Dwellings, Commonwealth, 1911.



GRAPH No. 163.

of rental values as was indicated on p. 417 for dwellings of 4, 5 and 6 rooms. It may also be noted that the average rental per room for all dwellings differs but slightly in each case from the corresponding average in the case of 5 room dwellings.

The accompanying graph (No. 163) furnishes a representation of the average weekly rental value per room in private dwellings for the Commonwealth as a whole as at 3rd April, 1911. The figures shewn at the feet of the several pillars denote the number of rooms contained,

while the scale on the left of the graph indicates the average weekly rental value in shillings per room in occupied private dwellings of the sizes indicated. The pillar marked "A.P.D." represents the average weekly rental value in shillings per room for "all private dwellings."

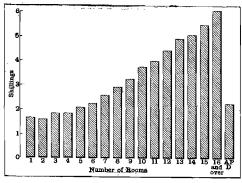
(v.) Average rental per inmate.—A further computation on the basis of rental values may be made in respect of the inmates occupying dwellings of varying sizes, thus giving the average weekly rental value per inmate for each specified size of dwelling. Such a result for the Commonwealth as a whole and for each State and Territory is given in the following table:—

Average Weekly Rental Value per Inmate in Occupied Private Dwellings. 3rd April, 1911.

	No. of	Room	s.	N.8	8.W.	V	ic.	Q'l	and.	s	.A.	W.	.A.	T	as.	N.	т.	F.	Τ.	C'w	lth
1	-			8.	d.	<i>s</i> .	d	s.	$\overline{d}$ .	s.	d	8.	d.	s.	d.	8.	d	8.	d.	8.	d.
ī	• •	• •	• •	1	9	1	7	1	6.	1	8	1	10	1	6	1	4	I	I	1	
2	• •	• •	• •	1	7	1	6	1	7	1	7	2	0	1	<b>2</b>	1	5	1	9	1.1	,
3	• •	• •		1	10	1	10	1	6	1	9	2	3	1	3	1	` 5	. 0	11	1	10
4				1	11	1	10	1	8	1	10	2	4	1	5	2	0	. 1	4	1	1
5				2	2	2	1	1	11	2	2	2	8	1	9	2	3	1	5	2	
6				2	5	2	3	2	1	2	4	3	0	1	10	2	0	1	2	2	
7				2	10	2	7	2	4	2	8	3	Ğ.	2	2	3	3	1	9	2	
8				3	2	2	11	2	$\bar{6}$	3	ŏ	3	10	2	5	3	2	2	ĩ	$\bar{2}$	1
9				3	7	3	4	2	8	3	5	4	ì	2	9	İ	_	2	$\tilde{2}$	3	-
Ď				4	i	3	10	3	ő	4	ő	4	4	3	2	4	. 5	3	5	3	
ĺ			• • •	4	4	4	2	3	2	4	5	4	8	3	5		_	2	7	4	
2 .		• •		4	9		7	3			-		9	3	7		•		•	4	
3	• •	• •	• •	5	3	.4 5	-	_	4	4	8	4			-		•		•		
į.	• •	• •	• •	_			1	4	0	5	7	4	6	3	6		•		•	4	1
	• •	• •	• •	5	3	5	5	3	8	5	10	5	6	3	10		•		•	5	
5		• •	• •	5	9	6	6	3	5	7	4	4	8	4	10					5	
6 а	nd over	r	• •	6	4	7	7	3	0	8	1	6	10	4	1	•	•.	. 1	4	6	
11 F	Private 1	Dwelli	ngs	2	5	2	4	I	11	2	3	2	7	1	9	1	7	1	7	2	

It will be seen that in the case of the Commonwealth and New South Wales the average for all private dwellings coincides with that for 6 room dwellings; and in Queensland and Tasmania with that for 5 room dwellings. In South Australia it lies between the averages for 5 and 6 rooms, while in Victoria it is slightly in excess of the 6 room average, and in Western Aus-

Average Weekly Rental Value per Inmate Private Dwellings, Commonwealth, 1911.



GRAPH No. 164.

The pillar marked "A.P.D." represents inmate for "all private dwellings."

tralia slightly below the five room average. For the Commonwealth as a whole it may be said that the average weekly value per head of population of the housing accommodation provided at the Census of 3rd April, 1911, was 2s. 3d., representing an annual value of approximately £27,000,000, or a capital value of £405,000,000 on the assumption that the capital value represents 15 years' purchase.

A representation of the average weekly rental value per inmate for private dwellings of various sizes is furnished in the accompanying graph (No. 164) for the Commonwealth as a whole as at 3rd April, 1911. The figures shewn at the feet of the pillars denote the number of rooms contained, while the scale on the left of the graph indicates the average weekly rental value in shillings per inmate in private dwellings of the sizes indicated. the average weekly rental value in shillings per

9. **Method of Occupancy.** (i.) General.—As previously indicated, statistics of method of occupancy were collected at the Census of 1911 for the first time in the history of Census taking in Australia. The data in respect of method of occupancy were classified under the four heads: (a) Occupied by owners, (b) Occupied by rent purchasers, (c) Occupied by tenants, (d) Other and unspecified methods of tenancy. The indefinite group (d) comprised less than  $5\frac{1}{2}$  per cent. of the total private dwellings. The data were tabulated in respect of private dwellings only.

(ii.) According to States.—The number of private dwellings classed under each occupancy group in each State and Territory is shewn in the following table:—

Private Dwellings.—Methods of Occupancy in States and Territories. 1911.

States and Territories.	Occupied by Owners.	Occupied by Rent Purchasers.	Occupied by Tenants.	Other and Unspecified Methods of Occupancy.	Total.
STATES-				, ,	
New South Wales	. 129,423	11,322	160,314	18,707	319,766
Victoria	. 118,716	13,973	119,562	11,383	263,634
Queensland	65,951	5,632	43,552	6,618	121,753
South Austral	37,387	4,294	37,431	2,996	82,108
Western Australia	. 34,335	2,534	23,623	6,061	66,553
Tasmania	15,848	1,558	19,457	2,087	38,950
Territories—	,	1	,		
Northern	. 772	2	321	99	1,194
Federal	205	3	111	112	431
Total, Commonwealth .	402,637	39,318	404,371	48,063	894,389

For the Commonwealth as a whole the number of private dwellings returned as occupied by owners was approximately equal to the number returned as occupied by tenants. A similar condition of approximate equality for these two methods of occupancy also existed in the cases of Victoria and South Australia. On the other hand, in the cases of New South Wales and Tasmania the dwellings returned as occupied by tenants exceeded the number returned as occupied by owners by upwards of 20 per cent., while in the remaining States (Queensland and Western Australia) the number returned as occupied by owners was markedly in excess of the number returned as occupied by tenants. Occupancy by rent purchasers was more in evidence in Victoria than in any other State.

Combining dwellings occupied by rent purchasers with those occupied by owners, and ignoring the indefinite group of "other and unspecified methods of occupancy," it may be said that, for the Commonwealth as a whole, approximately 52 per cent. of the private dwellings are occupied by owners or prospective owners, and 48 per cent. by tenants. A similar computation for the several States and Territories gives the following percentages for dwellings occupied by owners or prospective owners:—New South Wales, 47 per cent.; Victoria, 53 per cent.; Queensland, 62 per cent.; South Australia, 53 per cent.; Western Australia, 61 per cent.; Tasmania, 47 per cent.; Northern Territory, 71 per cent.; Federal Territory, 65 per cent.

(iii.) According to number of rooms.—The tabulation of the data relative to method of occupancy inconjunction with number of rooms, furnishes the following results for the Commonwealth as a whole ;—

Private Dwellings.—Methods of Occupancy and Number of Rooms. Commonwealth, 1911.

	Num	ber	of Roo	ms.		Occupied by Owners.	Occupied by Rent Purchasers.	Occupied by Tenants.	Other and Unspecified Methods of Occupancy.	Total.
1				·	·	34,920	708	13,715	17,176	66,519
<b>2</b>						22,178	1,673	18,487	3,127	45,465
3						25,030	3,340	40,086	2,864	71,320
4						78,289	11,206	109,341	6,858	205,694
5						78,235	11,093	96,422	5,115	190,865
6					٠	71,865	7,101	64,851	4,035	147,852
7						40,508	2,578	30,280	2,083	75,449
8						23,179	912	15,301	1,283	40,675
9						11,258	349	6,900	752	19,259
10						7,270	178	4,057	566	12,071
11						3,015	65	1,568	253	4,901
12						2,542	48	1,196	260	4,046
13						1,045	11	496	125	1,677
14						1,013	9	474	106	1,602
15						513	4	216	61	794
16				٠.		425	6	161	59	651
17						$\boldsymbol{222}$	3	95	30	350
18						178	1	69	29	277
19						87		28	12	127
20 a	nd over		•			558	3	192	109	862
$\mathbf{U}\mathbf{n}\mathbf{s}_{\mathbf{I}}$	pecified	• •	• •	• •		307	30	436	3,160	3,933
	TOTAL					402,637	39,318	404,371	48,063	894,389

In the case of dwellings of 3, 4 and 5 rooms the numbers occupied by tenants considerably exceeded the numbers occupied by owners and prospective owners. On the other hand for all dwellings of less than 3 or more than 5 rooms the numbers occupied by owners or prospective owners largely exceeded the numbers occupied by tenants.

(iv.) According to weekly rental value.—The next table furnishes for the Commonwealth as a whole a tabulation of the data relative to private dwellings according to method of occupancy and weekly rental value:—

Private Dwellings.—Method of Occupancy and Weekly Rental Value. Commonwealth, 1911.

WEEKLY I	RENTA	ΛL	VALUE.		Occupied by Owners.	Occupied by Rent Purchasers.	Occupied by Tenants.	Other and Unspecified Methods of Occupancy.	Total.
Under 5s					57,437	3,797	49,800	4,918	115,952
5s. and under	10s.				113,166	11,762	139,852	6,856	271,636
10s. ,,	15s.				81,848	12,759	105,786	4,224	204,617
15s. ,,	20s.			)	29,983	4,293	35,038	1,319	70,633
20s. ,,	25s.				20,333	2,432	16,787	869	40,421
25s. ,,	30s.				9,212	670	6,918	355	17,155
30s. ,,	35s.	٠.			5,765	261	3,564	227	9,817
35s. ,,	40s.				1,228	56	1,093	64	2,441
£2 ,,	£3				3,401	124	2,038	18	. 5,749
E3 ,,	£4				842	19	463	57	1,381
E4 ,,	£5			\	306	4	143	18	471
$\mathfrak{E}5$ and over					331	5	149	25	510
Unspecified		٠,		••	78,785	3,136	42,740	28,945	153,606
Total .					402,637	39,318	404,371	48,063	894,389

In the case of dwellings having weekly rental values (i.) from 5s. to 10s., (ii.) from 10s. to 15s., (iii.) from 15s. to 20s., the numbers occupied by tenants exceeded the numbers occupied by owners and prospective owners. On the other hands, for dwellings having a weekly rental value of less than 5s. or more than 20s., the numbers occupied by owners and prospective owners considerably exceeded the numbers occupied by tenants.

11. **Metropolitan.** (i.) Dwellings, occupied, unoccupied and being built.—The following table furnishes for each metropolitan area the number of dwellings recorded as occupied, unoccupied or being built at the date of the Census.

Metropolitan Dwellings Occupied, Unoccupied or Being Built. 1911.

		Num	BER.		P	ROPORTION	PER CEN	T.
METROPOLITAN AREA.	Occu- pied.	Unoccu- pied.	Being Built.	Total.	Occu- pied.	Unoccu- pied.	Being Built.	Total.
Sydney and Suburbs	123,234 119,562 27,532 38,742 21,897 8,082	2,491 2,418 627 1,090 1,070 368	751 682 175 312 37 37	126,476 122,662 28,334 40,144 23,004 8,487	97.43 97.47 97.17 96.51 95.19 95.23	% 1.97 1.97 2.21 2.71 4.65 4.34	.60 .56 .62 .78 .16	% 100.00 100.00 100.00 100.00 100.00
TOTAL METROPOLITAN AREAS	339,049	8,064	1,994	349,107	97.12	2.31	.57	100.00

As previously noted the returns received in respect of dwellings which were unoccupied or were being built were not entirely satisfactory, there being evidence that in some instances there had been failure to record such dwellings. It is of course impossible to determine the extent to which such omissions occurred, but it is believed that the metropolitan returns were fairly complete, and that in consequence the above table furnishes a fair approximation to the condition of the several metropolitan areas in respect of dwellings which were unoccupied or were being built.

(ii.) Dwellings and Inmates.—The following table furnishes, for each metropolitan area and for the whole in combination, a statement of the number of private and other dwellings and of their inmates, as well as of the number of inmates per dwelling.

Occupied	Metropolitan	Dwellings	and	Inmates.	3rd	April.	1911.

	No. o	of Dweli	LINGS.	No. o	of Inmat	ES	AVERAGE No. of Inmates PER DWELLING.				
METROPOLITAN AREA.	Private.	Other than Private.	Total.	Private.	Other than Private.	Total.	In Private Dwell- ings.	In Dwell- ings other than Private.	In all Dwell- ings.		
Sydney and Suburbs	118,427	4,807	123,234	567,590	61,676	629,266	4.79	12,83	5,11		
Melbourne & Suburbs	114,988	4,574	119,562	535,250	53,604	588,854	4,65	11.72	4.93		
Brisbane and Suburbs	26,645	887	27,532	127,053	12,418	139,471	4.77	14.00	5.07		
Adelaide and Suburbs	37,776	966	38,742	174,930	14,708	189,638	4.63	15.23	4.89		
Perth and Suburbs	21,129	768	21,897	94,070	12,714	106,784	4.45	16.55	4.88		
Hobart and Suburbs	7,737	345	8,082	35,941	3,986	39,927	4.65	11.55	4.94		
Total Metro- politan Areas	326,702	12,347	339,049	1,534,834	159,106	1,693,940	4.70	12.89	5.00		

In addition to the above there were recorded in the metropolitan areas 140 camps without dwellings, and these camps were occupied by 389 persons of whom 237 were recorded in Sydney, 117 in Melbourne, 9 in Brisbane, 8 in Adelaide, 8 in Perth, and 10 in Hobart.

(iii.) Number of rooms.—As in the case of the statistics for the whole of each State, the data in respect of the number of rooms in metropolitan dwellings indicates the following as a suitable grouping according to rooms, viz., 1 to 3 rooms, 4 to 6 rooms, 7 to 9 rooms, and 10 rooms and over. Grouped in this manner the figures for the metropolitan areas are as follows:—

Occupied Metropolitan Dwellings according to Number of Rooms. 3rd April, 1911.

					Numbei	R OF DWEL	LINGS.		
No. of Ro	oms.	•	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan Areas.
				PRIVA	re dweli	LINGS.			
1 to 3			12,923	12,579	1,920	6,409	3,992	872	38,695
4 to 6			81,434	76,922	17,837	24,582	14,620	4,880	220,275
7 to 9			19,744	20,814	5,870	5,579	2,037	1,475	55,519
10 and over			3,832	4,171	963	1,078	352	427	10,823
Unspecified		• •	494	502	55	128	128	83	1,390
TOTAL			118,427	114,988	26,645	37,776	21,129	7,737	326,702
			DWI	ELLINGS C	THER TH	IAN PRIVA	ATE.		
l to 3			127	142	24	17	17	7	334
4 to 6			1,187	820	184	180	179	45	2,595
7 to 9			1,586	1.528	253	252	197	100	3,916
10 and over			1,828	1,931	402	492	361	192 -	5,206
Unspecified			79	153	24	25	14	1	296
TOTAL	••		4,807	4,574	887	966	768	345	12,347
			<u> </u>	ALL	DWELLI	NGS.			
1 to 3			13,050	12,721	1,944	6,426	4,009	879	39,029
4 to 6	• •		82,621	77,742	18,021	24,762	14,799	4,925	222,870
7 to 9			21,330	22,342	6,123	5,831	2,234	1,575	59,435
l0 and over			5,660	6,102	1,365	1,570	713	619	16,029
Unspecified			573	655	79	153	142	84	1,686
Total			123,234	119,562	27,532	38,742	21,897	8,082	339,049

For the combined metropolitan areas private dwellings of 4 to 6 rooms represented about 68 per cent. of the total number of private dwellings for which the number of rooms was specified. The corresponding percentages in the case of the several metropolitan areas are as follows:—Sydney, 69 per cent.; Melbourne, 67 per cent.; Brisbane, 67 per cent.; Adelaide, 65 per cent.; Perth, 70 per cent.; Hobart, 64 per cent.

(iv.) Materials of outer walls.—In the construction of the outer walls of metropolitan dwellings in Australia the materials employed are mainly brick, wood and stone. These three materials account for more than 98 per cent. of the dwellings, the only other materials represented to any appreciable extent being iron and concrete, which together accounted for about  $1\frac{1}{3}$  per cent. of the total. The following table furnishes particulars for each metropolitan area in respect of the principal materials used :—

### Materials of Outer Walls of Metropolitan Dwellings. 3rd April, 1911.

		~ .	Number	of Dwell	INGS.		
Materials of which Outer Walls were Built.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan Areas.

#### PRIVATE DWELLINGS.

•				[		1		
Stone		4.553	1,730	81	20,679	1,933	643	29,619
Brick		87,768	55,683	1,300	11,996	11,168	3.547	171,462
Wood		24,648	56,219	24,932	2,193	6,859	3,381	118,232
Other Materials		833	859	282	2,741	990	61	5,766
Unspecified		625	497	50	167	179	105	1,623
TOTAL		118,427	114,988	26,645	37,776	21,129	7,737	326,702

#### DWELLINGS OTHER THAN PRIVATE.

Stone Brick Wood Other Materials. Unspecified		619 3,986 137 20 45	409 3,521 504 45 95	34 327 511 4 11	663 264 14 14 11	106 615 36 5 6	85 214 39 4 3	1,916 $8,927$ $1,241$ $92$ $171$
TOTAL		4,807	4,574	887	966	768	345	12,347

### ALL DWELLINGS.

		1					1
Stone	5,172	2,139	115	21,342	2,039	728	31,535
Brick	91,754	59,204	1,627	12,260	11,783	3,761	180,389
Wood	24,785	56,723	25,443	2,207	6,895	3,420	119,473
Other Materials	853	904	286	2,755	995	65	5,858
Unspecified	670	592	61	178	185	108	1,794
TOTAL	123,234	119,562	27,532	38,742	21,897	8,082	339,049

For the combined metropolitan areas brick dwellings predominated, exceeding the number of wooden dwellings by about 50 per cent. This predominance of brick dwellings held in all the capitals except Brisbane and Adelaide, wooden dwellings occupying the leading position in Brisbane, and stone dwellings in Adelaide. In the case of Melbourne wooden private dwellings slightly exceeded those built of brick, but amongst dwellings other than private the brick were considerably in excess of the wooden.

(v.) Weekly rental values.—Particulars concerning the number of occupied private dwellings in the metropolitan areas of the several States classified according to grouped weekly rental values are furnished in the following tables:—

Metropolitan Occupied Dwellings according to Weekly Rental Value. 3rd A	April, 191	1.
-------------------------------------------------------------------------	------------	----

			Number	OF DWELL	INGS.		
WEEKLY RENTAL VALUE	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hobart and Suburbs.	Total Metro- politan Areas.
	•	PRIVA	TE DWEL	LINGS.			
Under 5s	1,054	1,290	925	1,151	708	277	5,405
5s. and under 10s	20,736	29,430	7.942	9.825	4,917	2,314	75,164
los. " 15s	42,393	37,933	8,946	11,296	6,655	2,401	109,624
15s. ,, 20s	19,138	15,299	3,462	5,852	2,766	958	47,475
20s. " 25s	9,563	7,897	1,810	3,485	1,657	445	24,857
25s. ,, 30s	5,217	4,010	795	1,531	759	171	12,483
30s. ,, 35s	3,055	2,046	463	779	447	94	6,884
35s. " 40s	942	657	100	167	117	28	2,011
£2 ,, £3	1,948	1,314	226	390	252	54	4,184
£3 ,, £4	555	334	49	95	71	18	1,122
£4 ,, £5	211	113	23	41	15	3	406
E5 and over	205	166	7	28	11		417
Unspecified	13,410	14,499	1,897	3,136	2,754	974	36,670
Total	118,427	114,988	26,645	37,776	21,129	7,737	326,702
	DW	ELLINGS C	THER TH	AN PRIVA	TE.		<u>-</u>
Jnder 5s	5	7	4			1	17
Under 5s	73	112	33	"11	21	17	267
10	296	528	141	61	47	36	1,109
· "	808	709	139	91	84	47	1,103
	764	629	104	129	87	51	1,764
`	510	444	60	120	79	34	1,704
25s. ,, 30s	373	227	49	80	71	26	826
35s. ,, 40s	177	123	18	26	30	12	386
£2 ,, £3	381	375	51	96	74	30	1,007
£3 ,, £4	312	301	44	55	27	21	760
£4 ,, £5	195	187	12	49	21	īī	475
£5 and over	455		119	135	132	16	1,210
Unspecified	458	579	113	113	95	43	1,401
Total	4,807	4,574	887	966	768	345	12,347
	2/8	ALL	DWELLIN	rgs.			1
Under 5s.	1,059	1,297	929	1,151	708	278	5,422
5s. and under 10s	20,809	29,542	7,975	9,836	4,938	2,331	75,431
10s. " 15s	42,689	38,461	9,087	11,357	6,702	2,437	110,733
5s. ,, 20s	19,946	16,008	3,601	5,943	2,850	1,005	49,353
80s. ,, 25s	10,327•	8,526	1,914	3,614	1,744	496	26,621
25s. ,, 30s	5,727	4,454	855	1,651	838	205	13,730
35s	3,428	2,273	512	859	518	120	7,710
35s. ,, 40s	1,119	780	118	193	147	40	2,397
£2 • ,, £3	2,329	1,689	277	486	326	84	5,191
£3 ,, £4	867	635	93	150	98	39	1,882
£4 ,, £5	406	300	35	90	36	14	881
£5 and over	660	519	126	163	143	16	1,627
Unspecified	13,868	15,078	2,010	3,249	2,849	1,017	38,071
TOTAL	123,234	119,562	27,532	38,742	21,897	8,082	339,049

In all the capitals the predominant rental value groups were (i.) 10s. to 15s., (ii.) 5s. to 10s., (iii.) 15s. to 20s., in the order quoted. These three groups comprising all weekly rental values between 5s. and 20s. were represented by 232,263 private dwellings, or 80 per cent. of a total of 290,032 private dwellings for which the rental values were stated.

(vi.) Method of occupancy.—The succeeding table shews the number of occupied private dwellings in each metropolitan area classified according to the method of occupancy. Details in respect thereto in conjunction with weekly rental values will be found in Volume III., pp. 1969-1972.

Method of Occupancy of Metropolitan Private Dwellings. 1911.

	Number of Dwellings.										
METHOD OF OCCUPANCY.	Sydney and Suburbs.	Melbourne and Suburbs.	Brisbane and Suburbs.	Adelaide and Suburbs.	Perth and Suburbs.	Hob <b>a</b> rt and Suburbs.	Total Metro- politan Areas.				
Occupied by owner	31,211	32,089	10,239	13,400	7,400	2,286 239	96,625				
" by Rent Purchaser " by Tenant Other and unspecified	5,663 $78,492$	8,070 72, <b>2</b> 53	2,199 13,514	$2,228 \\ 21,272$	1,284 11,639	4,965	19,683 20 <b>2,</b> 135				
Occupancy	3,061	2,576	693	876	806	247	8,259				
TOTAL	118,427	114,988	26,645	37,776	21,129	7,737	326,702				

Omitting the group "other and unspecified occupancy," it will be seen that for the combined metropolitan areas, dwellings occupied by owners represented about 30 per cent. of the total, while those occupied by rent purchasers represented 6 per cent., and those occupied by tenants about 64 per cent. For the several metropolitan areas the percentages of total dwellings which were occupied by tenants were as follows:—Sydney, 68 per cent.; Melbourne, 64 per cent.; Brisbane, 52 per cent.; Adelaide, 58 per cent.; Perth, 57 per cent.; Hobart, 66 per cent.

12. Metropolitan and extra-metropolitan.—The next table furnishes in respect of dwellings an interesting comparison between the metropolitan and extra-metropolitan areas of the several States and exhibits each in comparison with the State and Commonwealth totals. :—

Metropolitan and Extra-Metropolitan Dwellings, 1911.

		Occupi	ер Dwei	LLINGS	Occupied	No. of	No. of	No. of Inmates	Ave	rage
Commonwealth States and Territories.	Area in Acres or Square Miles.	Private Houses and Tene- ments therein.	Other than Private.	Total.	Dwellings per Acre or Square Mile.	Inmates per Occupied Dwell- ing.	per	per Room in Occupied Dwell- ings.	Rental	
			METRO	POLITA:	N.					
Sydney and Suburbs Melbourne and Suburbs Brisbane and Suburbs	199,369	118,427 114,988 26,645	4,807 4,574 887	123,234 119,562 27,532	per acre 1.042 .717 .138	5.11 4.93 5.07	5.61 5.65 5.88	.90 .87 .86	8. 15 14 12	7 1 9
Adelaide and Suburbs Perth and Suburbs Hobart and Suburbs	150,596 85,835 58,687	37,776 $21,129$ $7,737$	966 768 345	$\begin{array}{c c} 38,742 \\ 21,897 \\ 8,082 \end{array}$	.257 .255 .138	4.89 4.88 4.94	5.32 5.04 5.88	.91 .95 .84	13 13 12	11 9 6
	779,525	326,702	12,347	339,049	.435	5.00	5.57	.89	14	5
		R	EMAIND	ER OF	STATES.	• '	<u> </u>	<u>'</u>		
New South Wales Victoria Queensland South Australia Western Australia Tasmania	sq. miles. 309,275 87,623 670,188 379,835 975,786 26,123	95,108 44,332 45,424	6,403 4,475 3,196 1,105 1,549 730	207,742 153,121 98,304 45,437 46,973 31,943	p.sq.m. .672 1.747 .147 .120 .048 1.223	4.84 4.70 4.68 4.74 3.54 4.71	5.10 5.40 4.78 4.84 3.47 4.81	.94 .87 .98 .98 1.02 .98	s. 8 8 8 7 8 7	d. 10 0 5 9 8
	2,448,830	566,062	17,458	583,520	.238	4.67	4.96	.94	8	4
	v	VHOLE 8	STATES	AND TE	RRITOR	IES.				
New South Wales Victoria Queensland South Australia Western Australia Tasmania Northern Territory Federal Territory	sq.miles. 309,460 87,884 670,500 380,070 975,920 26,215 523,620 912	263,634 $121,753$ $82,108$	11,210 9,049 4,083 2,071 2,317 1,075 54	330,976 272,683 125,836 84,179 68,870 40,025 1,248 442	p. sq.m. 1.070 3.103 .188 .221 .071 1.527 .002 .485	4.94 4.80 4.76 4.81 3.96 4.76 2.36 3.86	5.29 5.51 5.02 5.06 3.97 5.03 2.20 4.37	.87 .95 .95 .99	8. 11 10 9 10 10 8 3 7	$d. \\ 7 \\ 9 \\ 6 \\ 8 \\ 7 \\ 2 \\ 11 \\ 6$
Commonwealth	2,974,581	894,389	29,870	924,259	.311	4.78	5.18	.92	10	9

It will be seen that although in each State the number of inmates per occupied dwelling was greater in the metropolitan than in the extra-metropolitan area, the number of rooms per occupied dwelling was also greater, the outcome being that the average number of persons per room in occupied dwellings in the metropolis was less than was the case in the corresponding extra-metropolitan areas in all the States except Victoria, where the averages per room were equal.

Extensive details relative to the metropolitan areas of the several States, and in some instances to the extra-metropolitan areas also, are given in Vol. III., pp. 1962-77.

13. **Geographical subdivisions.**—Particulars in respect of the dwellings in the counties of New South Wales and Victoria, the counties and divisions of South Australia and the Northern Territory, the Census Districts of Queensland, the Statistical Districts of Western Australia, as well as the Local Government areas of all the States are contained in Vol. III., pp. 1978-2047.

# CHAPTER XXIII.

## GEOGRAPHICAL DISTRIBUTION.

1. General.—For practically all tabulations full details of the data derived from the Census Cards have been published for each State and Territory. This division into six States and two Territories constitutes the primary geographical distribution of the data. For the purpose of ascertaining the distribution according to areas less than States that would be most useful in each case, inquiries were made from the several State Statisticians, and on the basis of the advice tendered by them the following secondary geographical distribution was adopted :- New South Wales and Victoria into Counties; South Australia into Counties and Divisions; Queensland into Census Districts (approximately Registration Districts); Western Australia into Statistical Districts; and Tasmania into Municipalities. This distribution is that which is adopted in most cases in the several States for the publication of detailed local statistics. In most cases, in the compilation of Census data for the several States, the full details for the several sub-divisions indicated above have been compiled as a necessary step in the ascertainment of the aggregates for the States, but usually only a brief summary of the results has been published for each subdivision. In addition to these summary sub-divisional tables, somewhat more extensive data have been published in respect of the Metropolitan area of each State. In this case again the limits of the Metropolitan areas were adopted after consultation with the several State Statisticians concerned. In the cases of Melbourne and Brisbane, a circle of ten miles radius from the G.P.O. in each case was adopted, whilst in the other cases local government areas or parts thereof were pieced together to make up the Metropolitan area. With the object of presenting a key to the geographical distribution of data thus achieved, and also for the purpose of indicating graphically the density of population in the various areas the series of maps contained in the present chapter has been prepared. The initial map facing p. 425 is that of the Commonwealth of Australia, which shews graphically the density of population of the several States and Territories regarded as units. The density so shewn has been obtained by dividing the total population by the total area expressed in square miles. The degrees of density represented by the different varieties of hatching in the maps relating to the Commonwealth, the States and the Northern Territory are as follows:-

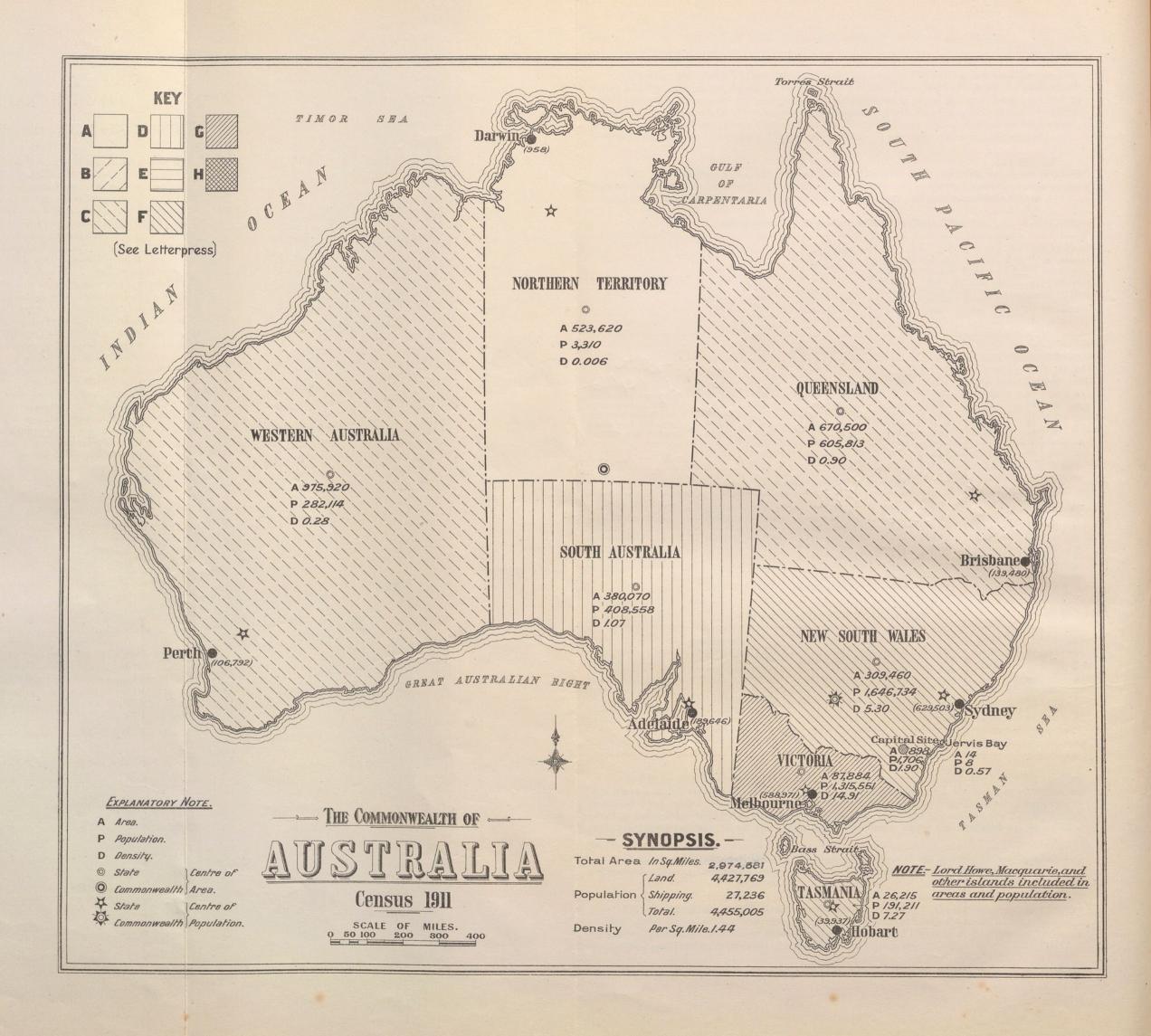
				on on 16 square miles. on 16 square miles		an 1	on 4	4 square miles.
C	,,	,,	1 ,,	4 ,,	,,,	1	,, 1	square mile.
D	,,	,,	1 ,,	1 square mile t	0 ,,	2	,, ]	Louisbar ,,
E	,,,	"	2 ,,	1 ,,	,,	4	,, 1	,, lane
F	,,	"	4 ,,	1 ,,	"	8	,, ]	,,
G	,,	"	8 ,,	1 "	"	16	,, 1	personale,, econ
H	,,	16 pe	ersons and	l upwards in 1 squar	e mile.			

2 Density of Population.—One of the striking features of the population of Australia is its extreme attenuation in relation to the extensive area over which it is spread. Speaking generally it may be said that little more than a coastal fringe is well populated, and even that mainly on the East and South East. Over a large part of the country there are scattered sheep and cattle stations with enormous distances between them. In other places small mining camps of prospectors, and in others, persons employed in the maintenance of rabbit proof fences and similar works. This wide scattering of population makes the collection of census data a work of an arduous nature, and one requiring a considerable amount of initiative and energy in the persons actually employed in collecting,

The area, population, and density of population of the several States and Territories, is shewn in the following table :—

Area, Population and Density of Population, 1911.

AND THE SELECTION			Area in		Density (Number of		
STATES AND TERRITOR	STATES AND TERRITORIES.		square miles.	Males.	Females.	Persons.	Persons per Square Mile)
STATES—							
New South Wales			309,460	850,221	788,462	1,638,683	5.30
Victoria	BUDE.	2.00	87,884	651,509	659,237	1,310,746	14.91
Queensland	7000		670,500	326,210	275,735	601,945	.90
South Australia			380,070	204,906	200,913	405,819	1.07
Western Australia			975,920	155,719	119,379	275,098	.28
Tasmania			26,215	97,031	93,604	190,635	7.27
TERRITORIES-			notice to the		CARD CHI	in of the second	
Northern			523,620	2,553	576	3,129	.006
Federal			912	992	722	1,714	1.88
COMMONWEALTH		Sign D	2,974,581	2,289,141	2,138,628	4,427,769	1.49



In addition to the population shewn in the preceding table, there were also enumerated 27,236 who were resident on shipping, of whom 23,894 were males, and 3,342 were females.

It will be seen that the most densely-populated States were the three situated in the South East, viz., Victoria (14.91), Tasmania (7.27), and New South Wales (5.30), the figures in parentheses denoting the average number of persons per square mile.

A defect which is present in any graphical representation of density is the uniformity of hatching or shading which is necessarily applied to the whole of the unit of area adopted for the purposes of the representation. Thus, when the unit is a State or a Territory, the hatching is the same for the whole State, notwithstanding the fact that some parts of the State may be uninhabited, while other part are densely populated. To remedy this defect more detailed maps may be prepared in which smaller units of area are adopted, but in practice it is impossible to entirely obviate it. In the present case, the maps of the several States shewing the average density of the subsidiary areas adopted therein furnish an indication of the distribution for the State concerned, while the maps furnished later for the metropolitan areas indicate approximately the distribution of the several metropolitan populations in respect of density.

3. Centre of area and centre of population.—On the present occasion, for the first time in connexion with an Australian Census, a determination was made of the centre of area and centre of population for each State and the Northern Territory, as well as for the Commonwealth as a whole. In respect of the centre of population such a determination is of considerable value when obtained for a series of censuses, as furnishing a measure of the trend which has taken place between Census and Census in the relative distribution of the population. The determination of the several points on the present occasion was effected by computations based upon the areas and populations of the counties of each of the States and the Northern Territory.

The latitude and longitude of the several centres of area and population are shewn in the

following table:-

Latitude and Longitude of Centres of Area and Population, 1911.

Partie	ılars.	~	N.S	.w.	v	ic.	Q'la	and.	S	Α.	w.	A.	Ta	s.	N.	т.	C'w	<b>l</b> th.
Centre of Area— Latitude . Longitude . Centre of Popula			32° 147°	31' 0'		25 ' 20 '		35 ' 10 '		56′ 45′					19° 133°		25° 134°	
Latitude .			33° 150°	40′ 15′	37° 144°	40′ 35′		15′ 41′							15° 131°		33° 145°	

As indicated above, the computation at future Censuses of centres of population for the several States and for the Commonwealth as a whole, will furnish a measure of the trend of population as regards geographical distribution. It is of interest to note in connexion with the centres determined on the present occasion for the several States and the Northern Territory, that in three cases, viz., New South Wales, South Australia, and the Northern Territory, the metropolis, the centre of population and the centre of area, are approximately in a straight line. In the cases of Victoria and Western Australia the centre of population lies slightly to the south of the straight line, joining the metropolis to the centre of area, while in Queensland and Tasmania the centre of population lies slightly to south of the corresponding line in these States. The centre of population is much nearer to the centre of area in Tasmania than in any other State. Similarly the centre of population is nearer the metropolis in Victoria than in any other As regards the Commonwealth as a whole, it may be noted that the centre of population lies slightly to the south of the straight line joining the centre of area to the Federal Capital site. The Commonwealth centre of population occupies approximately the same latitude as Sydney and the same longitude as Melbourne, and is on the straight line joining the New South Wales and South Australian centres of population.

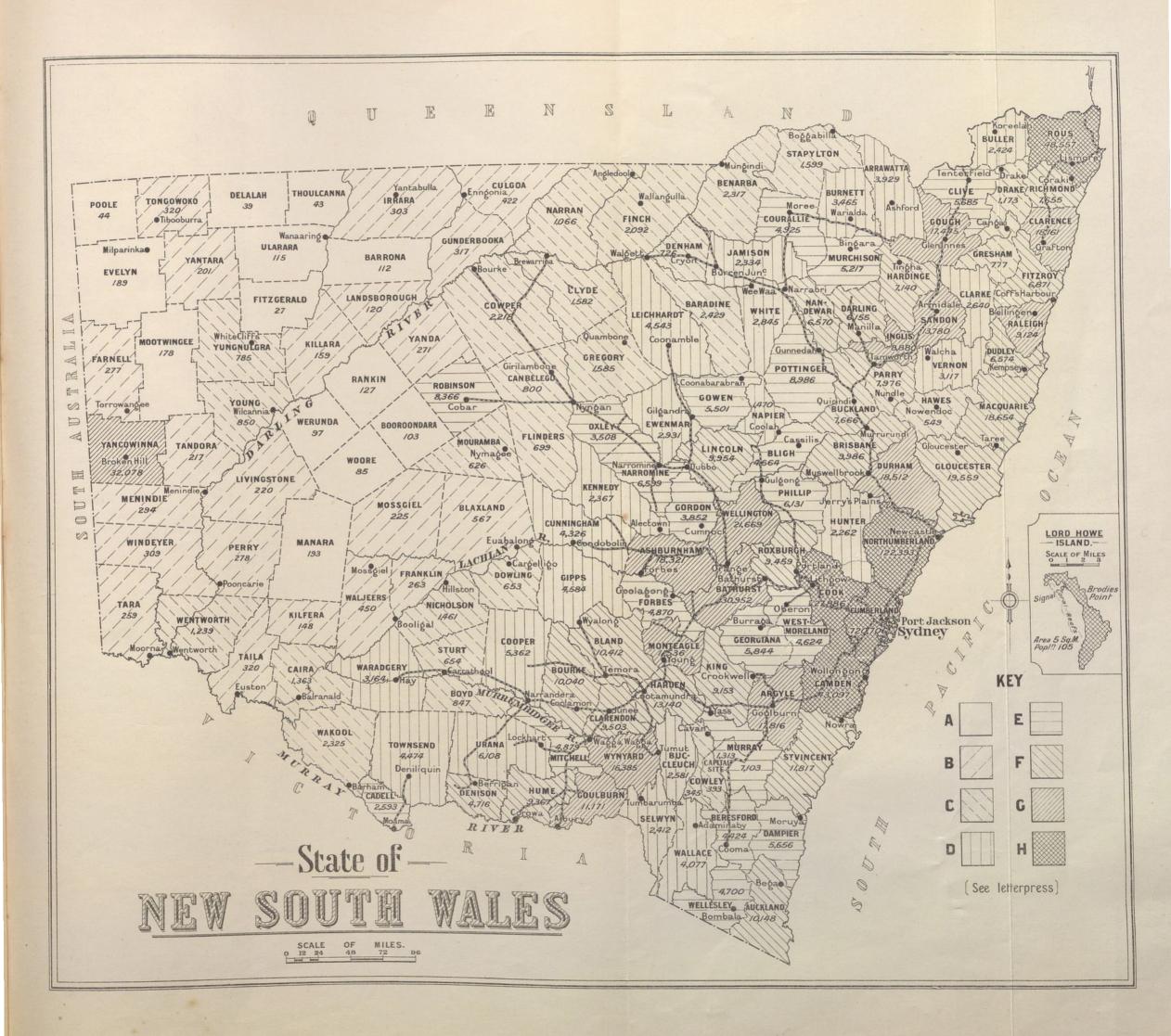
The distances of the centres of area and of population of the Commonwealth and of the several States and the Northern Territory from their respective metropolitan areas are approximately as follows:—

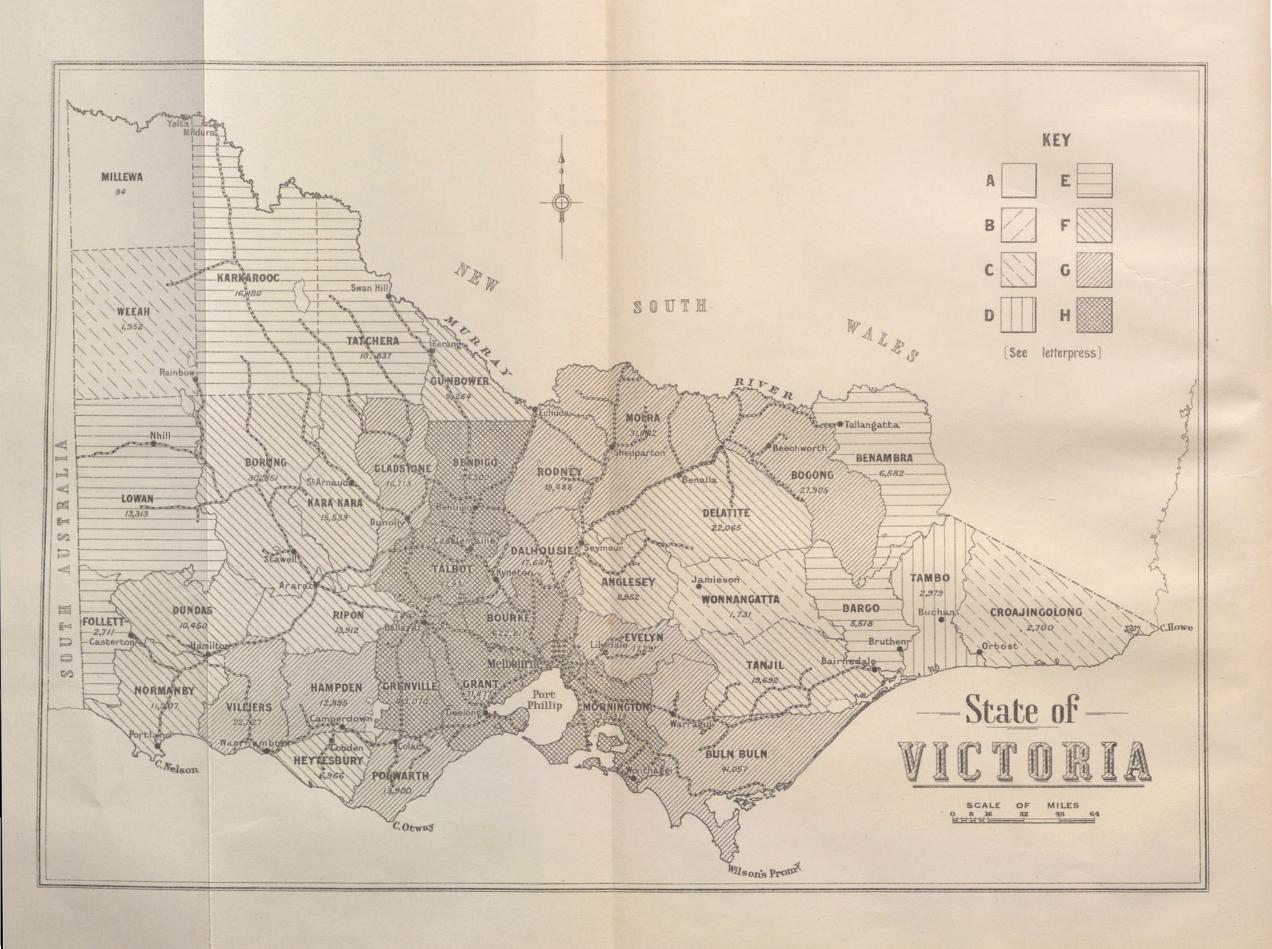
Distances of Centres of Area and Population from Metropolitan Areas, 1911.

Particulars.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	C'wlth.
Centre of area Centre of population	miles. 258 50	miles. 70 24	miles. 656 232	miles 380 25	miles. 586 100	miles. 76 66	miles. 492 202	miles. 1,130 235

The distances shewn in the above table represent approximately the distances from the centre of the metropolitan area in each case, the distance being measured from the centre of the Federal Capital Territory in the case of the Commonwealth.

4. Census Maps. (i.) The Commonwealth of Australia.—The map facing p. 425 shews the average densities of the several States and the Northern Territory, and also indicates the positions of the various centres of area and population discussed in the preceding section. The significance of the various grades of hatching will be seen on reference to the description on p. 425. The areas, populations, and densities are given in Section 2 above.





(ii.) New South Wales.—Facing p. (426) is given the map of New South Wales, shewing the boundaries of the counties comprised therein, and in most cases the principal town in each county. The principal rivers and railway lines are also shewn. In each case the total population of the county is shewn and the density is indicated in accordance with the scale given on p. 425.

The area, population, and occupied dwellings of the several counties is given in the accompanying table :—

Area, Population and Occupied Dwellings of New South Wales Counties, 1911.

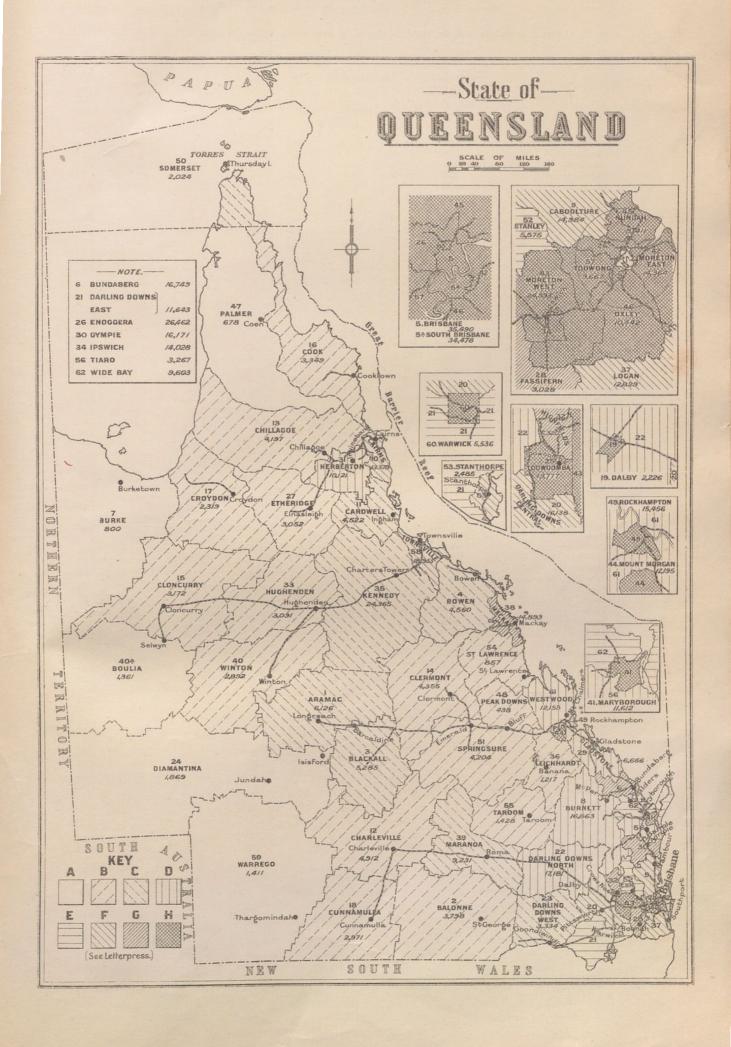
COUNTY.			•	OPULATION		Persons per	Occupied	Occupied Dwellings	tion per
		Square Miles.	Males.	Females.	Persons.	Square Mile.	Dwellings.	per Square Mile.	Occupied Dwelling.
Argyle	\	1,876	8,999	8,817	17,816	9.50	3,351	1,786	5.31
Arrawatta		2,297	2,304	1,625	3,929	1.71	795	346	4.92
Ashburnham	• •	2,179	9,683	8,638	18,321	8.41	3,688	1.693	4.95
Auckland Baradine		$\frac{2,050}{2,513}$	5,315 $1,394$	4,833 1,035	10,148 $2,429$	4.95	$2,030 \\ 476$	.990 .189	4.99 5.05
Barradine Barrona		2,572	90	1,033	112	.04	50	.019	2.22
Bathurst		1,982	16,097	14,855	30,952	15.62	6,278	3.168	4.91
Benarba		3,260	1,501	816	2,317	.71	404	.124	5.53
Beresford		1,482	2,374	2,050	4,424	2.99	857	.578	5.16
Bland	• •	$\begin{array}{c} 2,423 \\ 3,994 \end{array}$	$\begin{array}{c} 6,014 \\ 369 \end{array}$	4,398 198	$\begin{array}{c} 10,412 \\ 567 \end{array}$	4.30	$\begin{array}{c c} 2,133 \\ 101 \end{array}$	.880 .025	4.86 5.48
Blaxland Bligh		$\frac{3,994}{1,672}$	2,559	2,105	4,664	2.79	962	.575	4.83
Booroondarra		2,066	72	31	103	.05	13	.006	7.69
Bourke		2,230	5,977	4,063	10,040	4.50	2,003	.898	4.97
Boyd		1,534	519	328	847	.55	188	.123	4.28
Brisbane		2,281	5,329	4,657	9,986	4.38	1,870	.820	5.29
Buccleuch Buckland	• •	$\begin{array}{c c} 1,370 \\ 1,565 \end{array}$	$1,499 \\ 4,183$	1,082 3,483	2,581 7,666	1.88 4.90	555 1,471	.405	$4.61 \\ 5.12$
Buckland Buller	• •	1,303	1,427	997	2,424	1.64	580	.391	4.18
Burnett	• •	1,845	1,993	1,472	3,465	1.88	655	.355	5.18
Cadell		885	1,402	1,191	2,593	2.93	542	.612	4.71
Caira		2,590	813	550	1,363	.53	319	,123	4.22
Camden		$2,231 \\ 2,109$	22,035	21,062	43,097	19.32	8,767 177	3.930 .084	4.91 4.50
Canbelego Clarence		1,377	$\frac{490}{9,338}$	$\frac{310}{8,823}$	800 18,161	13.19	3,608	2.620	5.03
Clarence		1,200	5,259	4,244	9.503	7.92	1,867	1,556	5.08
Clarke		1,574	1,496	1,144	2,640	1.68	582	.370	4.51
Clive		1,726	2,973	2,712	5,685	3.29	1,225	.710	4.60
Clyde		2,777	935	647	1,582	.57	357	.129	4.34
Cook		$1,735 \\ 2,880$	$14,023 \\ 3,155$	13,863	27,886	16.07 1.86	5,938 1,248	3.422 .433	$4.69 \\ 4.29$
Cooper Courallie		1,964	2,810	2,207 $2,115$	5,362 $4,925$	2.51	933	.475	5.27
Cowley*	• • •	634	212	133	345	.54	76	.120	4.54
Cowper		4,681	1,229	989	2,218	.47	551	.118	3.97
Culgoa		2,538	267	155	422	.17	127	.050	3.27
Cumberland		1,673	352,990	367,716	720,706	430.79	141,275	84.444	$5.10 \\ 5.01$
Cunningham Dam <b>e</b> ier	• •	$egin{array}{c} 2,594 \ 1,658 \ \end{array}$	$\frac{2,465}{3,029}$	$1,861 \\ 2,627$	4,326 5,656	$\begin{vmatrix} 1.67 \\ 3.41 \end{vmatrix}$	$\begin{array}{c c} 861 \\ 1,192 \end{array}$	.332	4.73
Damper Darling	• •	1,540	3,319	2,836	6,155	4.00	1,137	.738	5.39
Delalah		2,290	32	7	39	.02	17	.007	2.29
Denham		1,482	466	260	726	.49	141	.095	5.03
Denison	• •	1,145	2,791	1,925	4,716	4.12	912	.797	5.15
Dowling Drake	• •	$1,833 \\ 1,336$	$\frac{408}{704}$	245 469	653 $1,173$	.36 .88	$\frac{144}{329}$	.079 .246	$\frac{4.53}{3.57}$
Drake Dudley		1,054	3,403	3,171	6,574	6.24	1,252	1,188	5.25
Durham		2,117	9,748	8,764	18,512	8.74	3,620	1.710	5.11
Evelyn		3,902	124	65	189	.05	53	.014	3.51
Ewenmar		2,070	1,811	1,120	2,931	1.42	622	.300	4.68
Farnell	• •	$\begin{array}{c} 2,921 \\ 4,226 \end{array}$	$188 \\ 1,453$	89 620	$\begin{array}{c} 277 \\ 2,092 \end{array}$	.09	65 601	0.022 $0.142$	$\frac{4.11}{3.39}$
Finch Fitzgerald		2,214	$\frac{1,453}{24}$	639	2,092	.01	4	.002	6.25
Fitzroy	• • •	1,540	3,920	2,951	6,871	4.46	1,484	964	4.61
Flinders	••	2,717	471	228	699	.26	172	.063	3.90
Forbes		1,429	2,818	2,052	4,870	3.41	1.016	.711	4.77
Franklin	• •	1,439	166	97	263	18	54	.038	4.87
Georgiana Gipps	• •	$\begin{array}{c} 1,923 \\ 2,791 \end{array}$	$3,165 \\ 2,710$	$2,679 \\ 1,874$	5,844 4,584	3.04 1.64	1,247 988	.648 .354	$\frac{4.67}{4.60}$
Gloucester		3,047	10,818	8,741	19,559	6.42	4,665	1,531	4.18
Gordon		1,455	2,254	1,598	3,852	2.65	865	.595	4.42
Gough		1,991	9,125	8,320	17,445	8.76	3,584	1.800	4.85
Goulburn	• •	1,347	5,802	5,369	11,171	8.29	2,296	1.705	4.85
Gowen	• •	1,788	3,093	2,408	5,501	3.08	1,080	.604	5.06
Gregory	• •	$oxed{3,080}\ 1,086$	$\substack{1,042\\488}$	$\frac{543}{289}$	1,585 777	.51 .72	335 198	.109	$\begin{array}{c} 4.69 \\ 3.92 \end{array}$
Gresnam Gunderbooka	• •	2,401	$\frac{488}{215}$	102	317	.13	73	.030	4.32
Harden		1,680	7,168	5,972	13,140	7.82	2,670	1.589	4.91
Hardinge		1,719	3,935	3,205	7,140	4.15	1,507	.877	4.71
Hawes		1,591	342	1 207	549	.35	127	.080	4.32
Hume Hunter	• •	$\begin{array}{c c} 1,575 \\ 2,153 \end{array}$	5,456	3,911	9,367	5.95 1.05	1,896	1.204	4.91
Hunter	• •	- ∠,193	1,250	1,012	2,262	1.05	444	.206	5.09

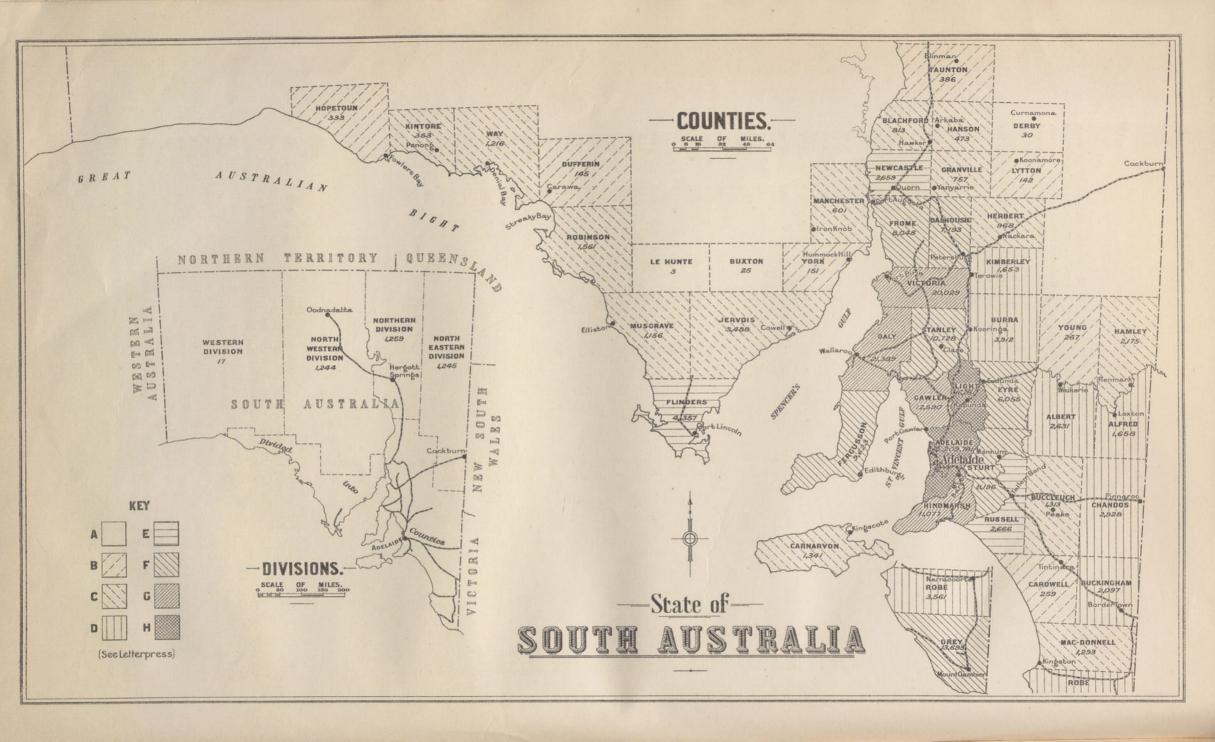
<sup>\*</sup> Exclusive of Territory transferred to Commonwealth.

Area, Population, and Occupied Dwellings in New South Wales Counties, 1911-continued.

	AREA.	P	OPULATION	r <b>.</b>	Persons per	Occupied	Occupied Dwellings	Popula tion pe
County.	Square Miles.	Males.	Females.	Persons.	Square Mile.	Dwellings.	per Square Mile.	Occupie Dwellin
nglis	872	4,572	4,308	8,880	10.18	1,713	1.964	5,1
rrara	4,271	220	83	303	.07	61	.014	4.7
amison	2,185	1,574	760	2,334	1.07	554	.254	4.0
ennedy	2,338	1,490	877	2,367	1.01	511	.219	4.8
Cilfera	1,618	105	43	148	.09	30	.019	4.9
illara	2,820	105	54	159	.06	43	.015	3.6
ing	1,831	4,838	4,315	9,153	5.00	1,809	.988	5.0
andsborough eichhardt	$\frac{2,057}{3,664}$	87	33	120	.06	34	.017	3.5
	1,902	2,617	1,926	4,543	1.24	905	.247	5.0
	$\frac{1,902}{3,872}$	$\begin{array}{c} 5,336 \\ 168 \end{array}$	4,618	9,954	5.23	2,034	1.069	4.8
r	2,523	10,072	52	220	.06	61	.016	3.3
acquarie anara	3,959	151	8,582 42	18,654 193	7.39	3,844	1.524 .014	4.8
	$\substack{3,359\\2,357}$	202	92	294	.12	70		3.3 4.1
24 -1. 11	1,465	2,978	1,901	4,879	3.33	1,002	.030 .684	4.5
onteagle	1,299	6,163	5,373	11,536	8.88	2,409	1.855	4.4
ootwingee	3,580	151	27	178	.05	35	.010	4.
ossgiel	3,886	134	91	225	.06	43	.010	5.
ouramba	2,447	343	283	626	.26	170	.069	3.
urchison	1,808	2,917	2,300	5,217	2.89	987	.546	5.
urray*	1,829	3,652	3,451	7,103	3.88	1,474	.806	4.
andewar	1,241	3,718	2,852	6,570	5.29	1,277	1,029	5.9
apier	1,021	876	594	1,470	1.44	310	.304	4.
arran	3,668	689	377	1,066	.29	188	.051	5.
arromine	1,880	3,702	2,897	6,599	3.51	1,281	.681	5.
cholson	2,229	840	621	1,461	.66	316	.142	4.
orthumberland	2,524	63,595	58,798	122,393	48.49	25,842	10.239	4.
dey	1,457	1,922	1,586	3,508	2.41	726	.498	4.
rry	1,356	4,512	3,464	7,976	5.88	1,668	1.230	4.
erry	2,978	177	101	278	.09	56	.019	4.9
ullip	1,617	$3,\!291$	2,840	6,131	3.79	1,309	.810	4.0
oole	2,016	35	9	44	.02	14	.007	2.9
ttinger	2,810	5,107	3,879	8,986	3.20	1,809	.644	4.9
aleigh	1,053	5,107	4,017	9,124	8.66	1,832	1.740	4.9
ankin	2,431	96	31	127	.05	40	.016	3.
chmond	1,148	4,165	3,490	7,655	6.67	1,561	1.360	4.8
obinson	2,193	4,822	3,544	8,366	3.81	1,727	.788	4.8
ous	2,281	26,534	22,023	48,557	21.29	9,428	4.133	5.
oxburgh	1,579	5,180	4,279	9,459	5.99	2,231	1.413	4.5
. Vincent*	2,616	6,185	5,632	11,817	4.52	2,582	.987	4.
1	$^{1,322}_{1,747}$	$6,894 \\ 1,355$	6,886	13,780	10.42	2,617	1.980	5.2
apylton	2,401	1,058	$\begin{array}{c} 1,057 \\ 541 \end{array}$	$\frac{2,412}{1,599}$	1.38	535 340	.306	4.4
urt	1,596	431	223	654	.07	164	.142	3.1
ila	2,297	187	133	320	.14	80	.035	3.9
ndora	2,376	144	73	217	.09	65	.027	3.5
ra	3,005	164	95	259	.09	47	.016	5.
oulcanna	1,670	32	lii	43	.03	6	.004	<b>-6</b> .
ngowoko	2,339	193	127	320	.14	87	.037	3.
wnsend	3,619	2,539	1,935	4,474	1.24	1,000	.276	4.
arara	2,693	82	33	115	.04	25	.009	4.
ana	3,082	3,718	2,390	6,108	1.98	1,270	.412	4.
rnon	1,715	1,659	1,458	3,117	1.82	584	.341	5.
akool	2,997	1,486	839	2,325	.78	443	.148	5.0
aljeers	2,635	282	168	450	.17	97	.037	4.
allace	2,214	2,259	1,818	4,077	1.84	787	.355	5.
aradgery	2,821	1,637	1,527	3,164	1.12	723	.256	4.
ellesley	1,600	2,508	2,192	4,700	2.94	995	.622	4.
ellington	1,921	11,096	10,573	21,669	11.28	4,618	2.404	4.
entworth	3,276	713	526	1,239	.38	272	.083	4.
erunda	2,254	69	28	97	.04	26	.012	3.
estmoreland	1,616	2,516	2,108	4,624	2.86	975	.603	4.
nite	1,869	1,631	1,214	2,845	1.52	562	.301	4.
ndeyer	3,245	196	113	309	.10	74	.023	3.
oore	2,264	68	17	85	.04	19	.008	4.
ynyard	1,725	8,592	7,793	16,385	9.50	3,249	1.883	5.0
. 1 -	2,636	17,624	14,454	32,078	12.17	6,978	2.647	4.
	2,838	156	115	271	.10	53	.019	5.0
	$\frac{2,915}{2575}$	160	41	201	.07	40	.014	4.8
oung ingnulgra	$\frac{2,575}{3,120}$	456	394	850	.33	181	.070	4.
ingnulgra itside Counties— Lord Howe Island	3,130 5	504 56	281	785 105	21,00	295	.094 4.600	4.
Whole State	309,460	850,221	788,462	1,638,683	5.30	330,976	1.070	4.9
Shipping		7,477	574	8,051				•••
TOTAL POPULATION								

<sup>\*</sup> Exclusive of Territory transferred to Commonwealth.





(iii.) Victoria.—The Census map of Victoria facing p. 427 shews the boundary of each county as well as the principal town contained therein, wherever there is a settlement of sufficient importance to warrant its being so classed. The principal railway lines are also shewn. In each case the population of the county is given and the degree of the density of population is indicated in accordance with the scale shewn on p. 425.

The area, population, and occupied dwellings of the several counties are contained in the following table:—

Area, Population and Occupied Dwellings of Victorian Counties, 1911.

G		AREA.	Po	OPULATION		Persons per	Occupied	Occupied Dwellings per	Popula- tion per
County.		Square Miles.	Males.	Females	Persons.	Square Mile.	Dwellings.	Square Mile.	Occupied Dwelling.
Anglesey		1,647	4,772	4,180	8,952	5.44	1,886	1.145	4.72
Benambra		2,749	3,625	2,957	6,582	2.39	1,374	.500	4.77
Bendigo		1,949	26,771	27,729	54,500	27.96	12,239	6.280	4.45
Bogong		3,069	14,681	$13,\!224$	27,905	9.09	5,706	1.859	4.89
Borung		4,293	16,289	14,562	30,851	7.19	6,242	1.454	4.93
Bourke		1,721	295,309	327,502	622,811	361.89	126,430	73.463	4.92
Buln		3,739	$22,\!283$	18,774	41,057	10.98	8,811	2.357	4.65
roajingolong	• •	3,396	1,510	1,190	2,700	.80	617	.182	4.37
Dalhousie	••	1,310	8,917	8,724	17,641	13.47	3,946	3.012	4.45
Dargo	• •	1,744	3,077	2,441	5,518	3.16	1,307	.749	4.22
Delatite		3,240	11,491	10,574	22,065	6.81	4,558	1.407	4.83
Dundas		2,028	5,298	5,152	10,450	5.15	2,117	1.044	4.92
Evelyn	• •	$1,\!172$	9,026	8,265	17,291	14.75	3,917	3.342	4.41
Follett	• •	1,103	1,372	1,339	2,711	2.46	550	.499	4.92
Gladstone	•••	1,802	8,752	7,961	16,713	9.27	3,739	2.075	4.46
Grant		1,834	34,991	36,486	71,477	38.97	15,300	8.342	4.66
Grenville	• •	1,465	20,503	22,567	43,070	29.40	9,445	6.447	4.55
Junbower	• •	1,348	5,083	4,181	9,264	6.87	1,852	1.374	4.98
Iampden	• •	1,561	6,707	6,188	12,895	8.26	2,572	1.648	5.01
Heytesbury .		920	3,705	3,261	6,966	7.57	1,404	1.526	4.94
Kara Kara		2,290	8,265	7,274	15,539	6.79	3,229	1,410	4.81
Karkarooc	• •	5,935	9,618	6,562	16,180	2.73	3,298	.556	4.88
Lowan	• •	4,971	7,082	6,231	13,313	2.68	2,526	.508	5.27
Millewa	• •	3,572	56	28	84	.02	19	.005	4.42
Moira	• •	3,104	16,814	15,028	31,842	10.26	6,296	2.028	5.04
Mornington		1,625	19,034	16,279	35,313	21.73	7,861	4.838	4.49
Normanby	• •	2,013	5,900	6,007	11,907	5.92	2,517	1.250	4.72
Polwarth	• •	1,225	7,367	6,533	13,900	11.35	2,832	2.312	4.89
Ripon	• •	1,759	7,464	6,448	13,912	7.91	2,738	1.557	5.07
Rodney	• •	1,699	10,399	9,089	19,488	11.47	4,146	2.440	4.69
Talbot	• •	1,621	23,567	24,364	47,931	29.57	10,733	6.621	4.46
Tambo	• •	1,958	1,650	1,329	2,979	1.52	632	.323	4.71
Fanjil	• •	2,818	10,130	9,562	19,692	6.99	4,190	1.487	4.70
Tatchera	• •	3,339	6,318	4,519	10,837	3.25	2,131	.638	5.08
Villiers	• •	1,637	11,430	11,297	22,727	13.88	4,537	2.772	5.00
Weeah Wonnangatta		$\substack{4,004\\2,224}$	1,255 $998$	697 733	1,952 $1,731$	.49 .78	549 437	.137 .196	3.54 3.91
Whole State		97 994	851 500	650 005		1401	979 609	3,103	4.80
Shipping		87,884 	$651,509 \\ 4,082$	659,237	$\begin{vmatrix} 1,310,746 \\ 4,805 \end{vmatrix}$	14.91	272,683	3.103	4.80
Total Population			655,591	659,960	1,315,551				

(iv.) Queensland.—The Census map of Queensland, which is given facing p. 428, shews the boundary of each Census District, and where practicable the name and situation of the principal town therein. The principal railway lines are also shewn. In each case the population of the district is given, and the density of the population is indicated by hatching in accordance with the scale given on p. 425. Owing to the relatively small area of some of the more populous of the Census Districts, it has been impracticable to furnish adequate representation of all on the same scale. A number of insets has consequently been prepared to which reference should be made in the case of the districts in question. The numbers shewn before the name of the District in each case is the Census District number, which was used for reference in connexion with the collection and tabulation of the data.

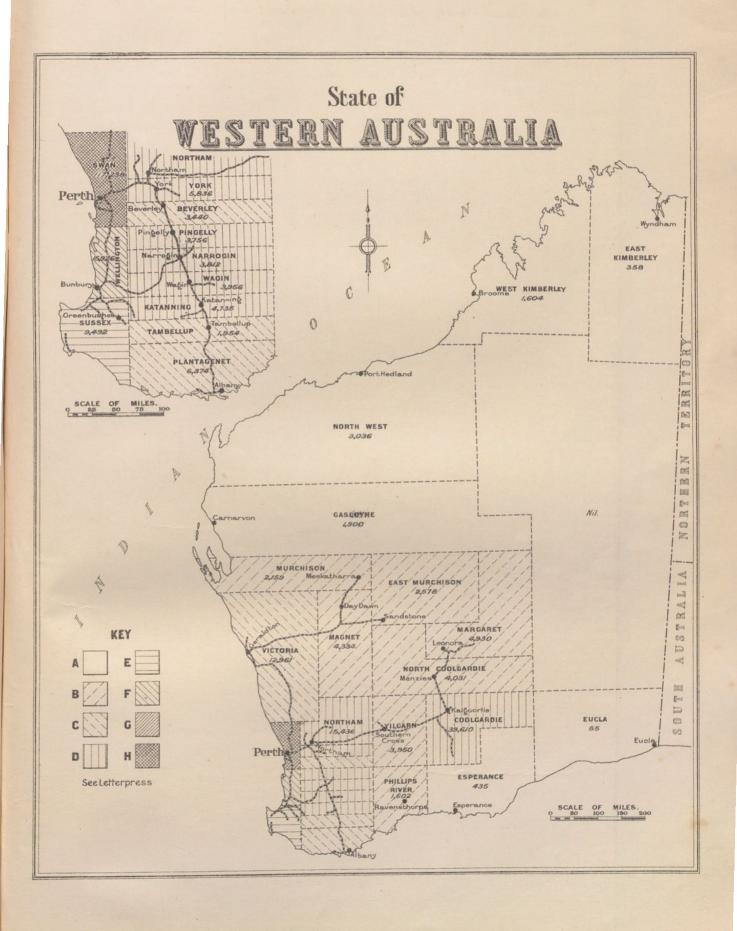
In certain cases, where there was sufficient space to indicate the density but not sufficient to give also the name of the district and the population, this district Census number only has been inserted on the map, the missing particulars being given in a note on the upper left side of the map.

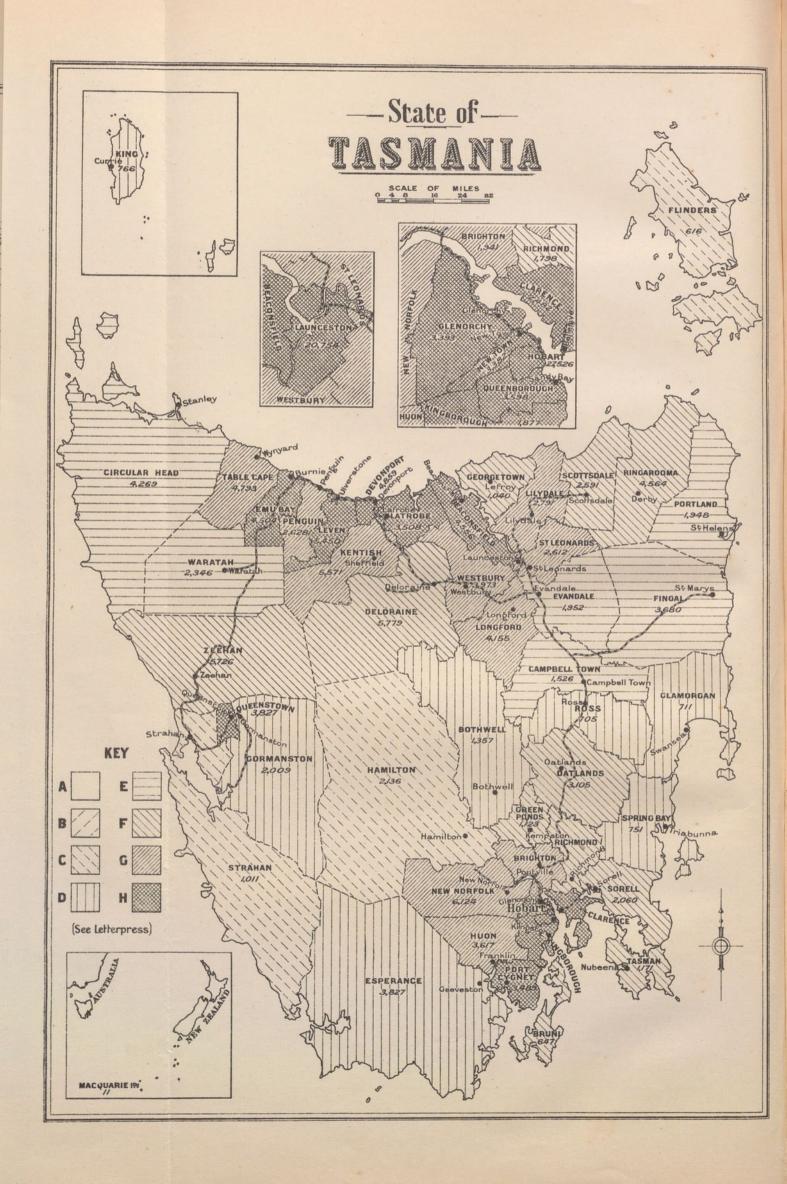
The area, population, and occupied dwellings of the several Census Districts of Queensland are given in the succeeding table :—

Area, Population, and Occupied Dwellings of Queensland Census Districts, 1911.

	AREA.	P	OPULATION	г.	Persons per	Occupied	Occupied Dwellings	Popula- tion per
CENSUS DISTRICT.	Square Miles.	Males.	Females.	Persons.	Square Mile.	Dwellings.	per Square Mile.	Occupied Dwelling
Aramac	20,467	3,979	2,147	6,126	.30	1,236	.060	4.84
Balonne	26,247	2,630	1,168	3,798	.14	₹ 950	.036	3.96
Blackall	14,539	3,241	2,044	5,285	.36	1,054	.072	4.95
Boulia	30,320	980	381	1,361	.04	247	.008	5.11
Bowen	11,642	2,684	1,876	4,560	39	1,059	.091	4.30
Brisbane, North	5.5	17,542	17,948	35,490	6452.73	6,384	1160.727	5.56
Brisbane, South	4.5	16,396	18,082	34,478	7661.78	6,916	1536.889	$oxed{4.99} \ 4.90$
Bundaberg	1,843	9,238	7,511	16,749	9.09	3,414	$1.852 \\ .004$	$\begin{array}{c} 4.90 \\ 4.62 \end{array}$
Burke Burnett	$38,866 \\ 12,436$	$\begin{array}{c} 579 \\ 9,757 \end{array}$	$\begin{array}{c} 221 \\ 7,106 \end{array}$	16,863	1.36	$\frac{168}{3,910}$	.314	4.30
Caboolture	2,020	8,261	6,723	14,984	7.42	3,157	1,563	4.74
Cairns	2,289	8,380	4,998	13,378	5.84	2,938	1.284	4.52
Cardwell	6,761	3,007	1,515	4,522	.67	1,010	.149	4.46
Charleville	22,305	3,183	1,729	4,912	.22	1,015	.046	4.80
Chillagoe	25,319	2,559	1,638	4,197	17	1,163	.046	3.60
Clermont	19,110	2,661	1,694	4,355	.23	1,178	.062	3.67
Cloneurry	28,747	2,211	961	3,172	.11	840	029	3.61
Cook	17,139	2,016	1,333	3,349	.20	858	.050	$\frac{3.90}{3.89}$
Croydon Cunnamulla	$20,153 \\ 19,424$	$1,\!261$ $1,\!996$	$1,058 \\ 975$	$\begin{array}{c} 2,319 \\ 2,971 \end{array}$	.12 $.15$	593 674	.029 .035	3.89 4.38
Dalby	2.5	1,071	1,155	2,226	890.40	413	165.200	5.38
Darling Downs, Central	2,537	9,052	7,086	16,138	6.36	3,037	1.197	5.29
Darling Downs, East	4,564	6,684	4,959	11,643	2.55	2,476	.543	4.69
Darling Downs, North	10,593	9,851	7,330	17,181	1.62	3,675	.347	4,66
Darling Downs, West	7,716	2,114	1,220	3,334	.43	803	.104	4.11
Diamantina	56,697	1,371	498	1,869	.03	418	.007	4.12
Enoggera	30	12,631	13,831	26,462	882.07	5,450	181.667	4.86
Etheridge	14,428	2,042	1,010	3,052	.21	1,083	.075	2.81
Fassifern Gladstone	$975 \\ 3,923$	$\frac{4,733}{3,676}$	$\frac{4,295}{2,980}$	$\begin{array}{c} 9,028 \\ 6,656 \end{array}$	$\frac{9.26}{1.70}$	$egin{array}{c} 1,647 \ 1,475 \end{array}$	$1.689 \\ .376$	$5.48 \\ 4.51$
Gympie	1,848	8,282	7,889	16,171	8.75	3,412	1.846	4.74
Herberton	5,614	6,423	3,698	10,121	1.80	3,093	.551	$\frac{1.11}{3.27}$
Highfields ·	707	3,394	2,926	6,320	8.94	1,346	1.904	4.69
Hughenden	17,503	2,055	1,036	3,091	.18	695	.040	4.30
Ipswich	40	6,981	7,047	14,028	350.70	2,672	66.800	5.25
$\hat{\mathbf{K}}$ ennedy	30,453	12,688	11,677	24,365	.80	5,632	.185	4.32
Leichhardt	6,458	800	417	1,217	.19	329	.051	3.68
Logan	1,682	6,729	6,100	12,829	7.63	2,509	1.492	5.11
Mackay Maranoa	$1,802 \\ 13,330$	$8,656 \\ 5,198$	$6,237 \\ 4,033$	$14,893 \\ 9,231$	$8.26 \\ .69$	$\frac{3,090}{1,913}$	$1.715 \mid .144$	$\frac{4.81}{4.79}$
36 1 1	,			,		,		
Maryborough	$\begin{array}{c} 339 \\ 210 \end{array}$	$\substack{5,655\\7,672}$	$5,957 \\ 6,692$	$11,612 \\ 14,364$	$\frac{34.25}{68.40}$	$2,334 \\ 2,824$	$6.885 \ 13.448$	$\frac{4.97}{5.07}$
7.5	1,390	13,135	11,858	$\frac{14,304}{24,993}$	17.98	4,891	$\frac{13.448}{3.519}$	5.10
Manual Manual	432	$\substack{6,622}$	5,573	12,195	28.23	2,614	6.051	4.66
37 11	80	8,900	9,511	18,411	230.14	3,501	43.763	5.26
Nundan Oxley	204	5,258	5,184	10,442	51.19	1,913	9.377	5.46
Palmer	30,734	499	179	678	.02	313	.010	2.17
Peak Downs	5,398	280	158	438	.08	99	.018	4.41
Rockhampton	55	* 7,376	8,080	15,456	281.02	2,859	51.982	5.41
St. Lawrence	8,893	530	327	857	.10	184	.021	4.65
Somerset	4,482	1,386	638	2,024	.45	451	.101	3.75
Springsure	18,066	2,556	1,648	4,204	.23	1,105	.061	3.78
Stanley	1,691	3,117	2,458	5,575	3.30	1,105	653	5.03
Stanthorpe	318	1,259	1,226	2,485	7.81	532	1.673	4.66
Taroom Tiaro	$\begin{smallmatrix}10,201\\1,757\end{smallmatrix}$	$\begin{array}{c} 883 \\ 1,805 \end{array}$	$\begin{array}{c} 545 \\ 1,462 \end{array}$	$\frac{1,428}{3,267}$	$.14 \\ 1.86$	$\begin{array}{c} 288 \\ 716 \end{array}$	.028 .408	$\frac{4.89}{4.56}$
	85	$\substack{1,805\\4,565}$	5,102	$\frac{3,267}{9,667}$	113.73	2,012	23.671	4.80
roowong roowoomba	81.5	9,389	10,388	19,777	242.66	3,586	44.000	5.51
Townsville	2,927	10,500	8,453	18,953	6.48	3,570	1.220	5.30
Warrego	50,208	1,012	399	1,411	.03	256	.005	. 4,92
Warwick	24	2,657	2,879	5,536	230.67	1,077	44,875	5.14
Westwood	6,107	6,557	5,596	12,153	1.99	2,710	.444	4.48
Wide Bay	2,532	5,490	4,113	9,603	3.79	2,183	.862	4.38
Winton	23,746	2,115	777	2,892	.12	781	.033	3.51
Whole State Shipping	670,500	326,210 3,296	275,735 572	601,945 3,868	.90	125,836	.188	4.76
Total Population			276,307					<del></del>
TOTAL TOPULATION		329,506	410,301	605,813		•••	• •	

<sup>(</sup>v.) South Australia.—The Census map of South Australia, facing p. 429, shews the boundaries of each of the counties into which the more populous parts of that State is divided. The portion of the State not divided into counties is divided for statistical and certain other purposes, into four sections known as (i.) the North Eastern Division, (ii.) the Northern Division,





(iii.) the North Western Division, and (iv.) the Western Division. These latter Divisions are very sparsely populated, and their boundaries are shewn in the small inset entitled Divisions. For convenience in presentation, the two counties of Robe and Grey in the extreme south east corner of the State are also shewn as an inset on the same scale as the remaining counties. Where practicable the name and position of the principal town has been given, and the principal lines of railway have been shewn. The population of each county and division is also shewn, and the density of each is indicated in accordance with the scale given on p. 425.

The area, population, and occupied dwellings of the counties and divisions of South Australia are shewn in the following table:—

Area, Population and Occupied Dwellings of South Australian Counties and Divisions, 1911.

-	AREA.	Р	OPULATION		Persons per	Occupied	Occupied Dwellings per	Popula- tion per
COUNTY OR DIVISION.	Square Miles.	Males.	Females.	Persons.	Square Mile.	Dwellings.	Square Mile.	Occupied Dwelling.
Adelaide	1,141	100,659	109,122	209,781	183.86	43,111	37.784	4.87
Albert	2,174	1,633	998	2,631	1.21	592	.272	4.44
Alfred	1,503	1,070	588	1,658	1.10	358	.238	4.63
Blachford	1,135	427	386	813	.72	183	.161	4.41
Buccleuch	2,330	845	468	1,313	.56	317	.136	4.14
Buckingham	$1,791 \\ 2,080$	1,086	1,011	2,097	1.17	452	.252	4.64
Burra Buxton	1,550	2,032 17	1,880	3,912	1.88	841	.404	4.65 3.67
O 1 11	1,670	160	$\begin{bmatrix} 8\\99 \end{bmatrix}$	$\begin{array}{c} 25 \\ 259 \end{array}$	.02	F 3 61	.002 .037	4.25
Carnarvon	1,680	729	612	1,341	.80	309	.184	4.34
Chandos	2,620	1,828	1,100	2,928	1.12	575	.219	4.98
Dalhousie	1,230	3,741	3,452	7,193	5.85	1,431	1.163	5.03
Daly	1,658	10,837	10,552	21,389	12.90	4,383	2.644	4.88
Derby	1,484	25	5	30	.02	7	.005	4.29
Dufferin Eyre	2,623 1,415	$\frac{105}{3,191}$	$\frac{40}{2,864}$	$\frac{145}{6,055}$	$\begin{array}{c} .06 \\ 4.28 \end{array}$	1,223	.016	3.40 4.95
Eyre Ferguson	1,858	5,275	4,348	9,623	5.18	2,046	1.101	4.70
Flinders	1,850	2,400	1,957	$\frac{9,023}{4,357}$	$\frac{5.18}{2.36}$	893	.483	4.88
Frome	1,508	4,251	3,797	8,048	5.34	1,615	1.071	4.98
Gawler	928	6,447	6,143	12,590	13.57	2,587	2.788	4.86
Granville	1,168	426	331	757	.65	148	.127	5.10
Grey	2,044	6,825	6,868	13,693	6.70	2,846	1.392	4.80
Hamley Hanson	$2,194 \\ 1,259$	1,267 275	908	2,175	.99	519	.237	4.04 5.50
TT 1 /	1,532	534	$\frac{198}{434}$	$\frac{473}{968}$	.38	$\begin{array}{c} 86 \\ 208 \end{array}$	.068	4,65
Herbert Hindmarsh	1,025	5,289	5,788	11,077	10.81	2,387	2.329	4.64
Hopetoun	2,400	226	107	333	.14	58	.024	5.03
Jervois	3,686	2,177	1,311	3,488	.95	710	.193	4.75
Kimberley	1,388	876	777	1,653	1.19	362	.261	4.57
Kintore	1,418	223	130	353	.25	82	.058	4.21
Le Hunte	1,650	2 2 14	1	3	.002	1 2 7 0 1	.001	3.00
Light Lytton	839 1,381	8,214 100	$\begin{array}{c} 8,067 \\ 42 \end{array}$	$16,281 \\ 142$	19.41 .10	3,501 43	4.173	$egin{array}{c} 4.65 \ 3.30 \ \end{array}$
MacDonnell	1,845	672	621	1,293	70	279	.151	4.63
Manchester	1,930	340	261	601	.31	130	.067	4.58
Musgrave	2,450	635	521	1,156	.47	229	.093	5.05
Newcastle	1,221	1,370	1,289	2,659	2.18	533	.437	4.99
Robe	1,962	1,836	1,725	3,561	1.81	800	.408	4.44
Robinson	2,674	930	631	1,561	.58	299	.112	5.21
Russell	1,323	1,483	1,183	2,666	2.02	593	.448	4.50
Stanley	1,574	5,690	5,038	10,728	6.82	2,201	1.398	4.87
Sturt	1,328	4,349	3,847	8,196	6.17	1,712	1.289	4.79
Taunton	2,147	225	161	386	.18	104	.048	3.63
Victoria	1,431	10,517	9,512	20,029	14.00	4,047	2.828	4.95
Way	2,610	784	432	1,216	.47	290	.111	4.18
York Young	1,320	$\begin{array}{c} 89 \\ 161 \end{array}$	62	151	.111	35 61	.027	$\begin{array}{c c} 4.09 \\ 4.38 \end{array}$
Outside Counties—	2,076		106	267	.13		.029	
Northern Division	٦	$\begin{bmatrix} 791 \\ 907 \end{bmatrix}$	468	1,259	۱٦	289	١	4.03
North Eastern Div. North Western Div.	297,967	907	338	1,245	.01	327	.003	$\begin{bmatrix} 3.62 \\ 4.50 \end{bmatrix}$
Western Division	J	$\begin{array}{c c} 920 \\ 15 \end{array}$	$\begin{array}{c} 324 \\ 2 \end{array}$	$\substack{1,244\\17}$	J	$\begin{bmatrix} 266 \\ 4 \end{bmatrix}$	J	$\frac{4.50}{3.00}$
Whole State	380,070	204,906	200,913	405,819	1.07	84,179	.221	4.81
Shipping		2,452	287	2,739				
TOTAL POPULATION		207,358	201,200	408,558	• •			

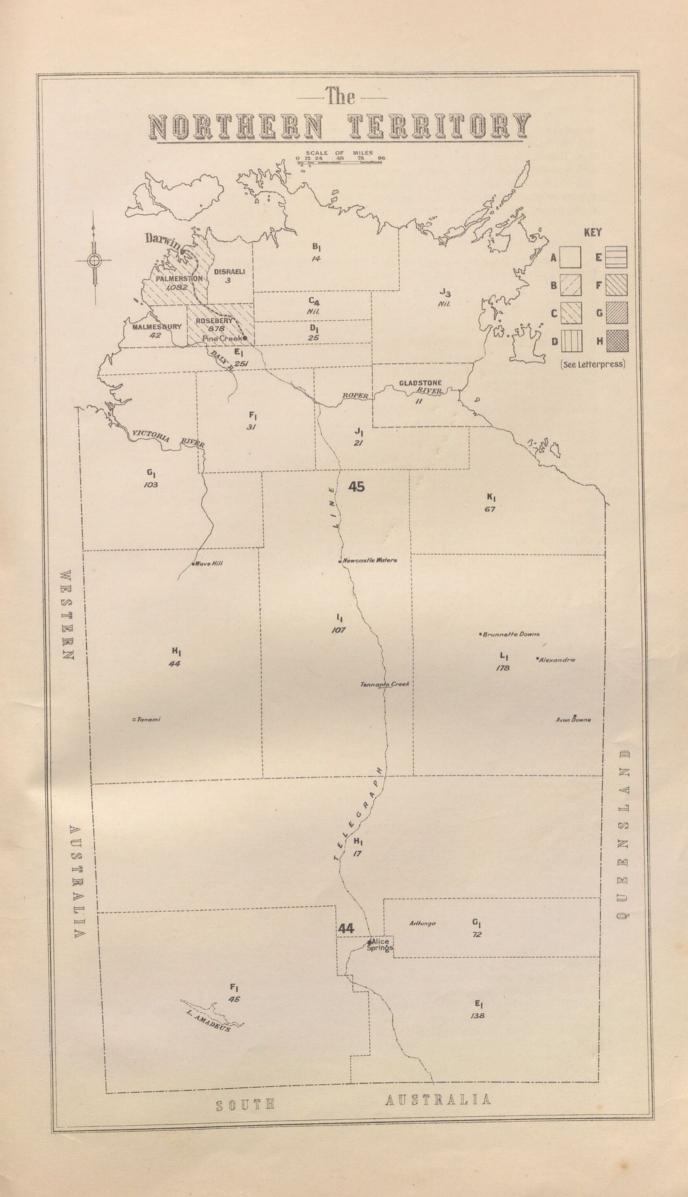
(vi.) Western Australia.—The Census map of Western Australia facing p. 430 shews the boundary of each of the districts which have been adopted in that State for statistical purposes, and are hence known as statistical districts. The position and name of the principal town in each District is shewn on the map, and also the principal lines of railway. The population of each district is also shewn in each case, and the density of each is indicated in accordance with the scale shewn on p. 425. Owing to the restricted space available on the map of the whole State for display of particulars relative to the South West Division, an inset of this Division has been given in the upper left margin on twice the scale used for the whole State.

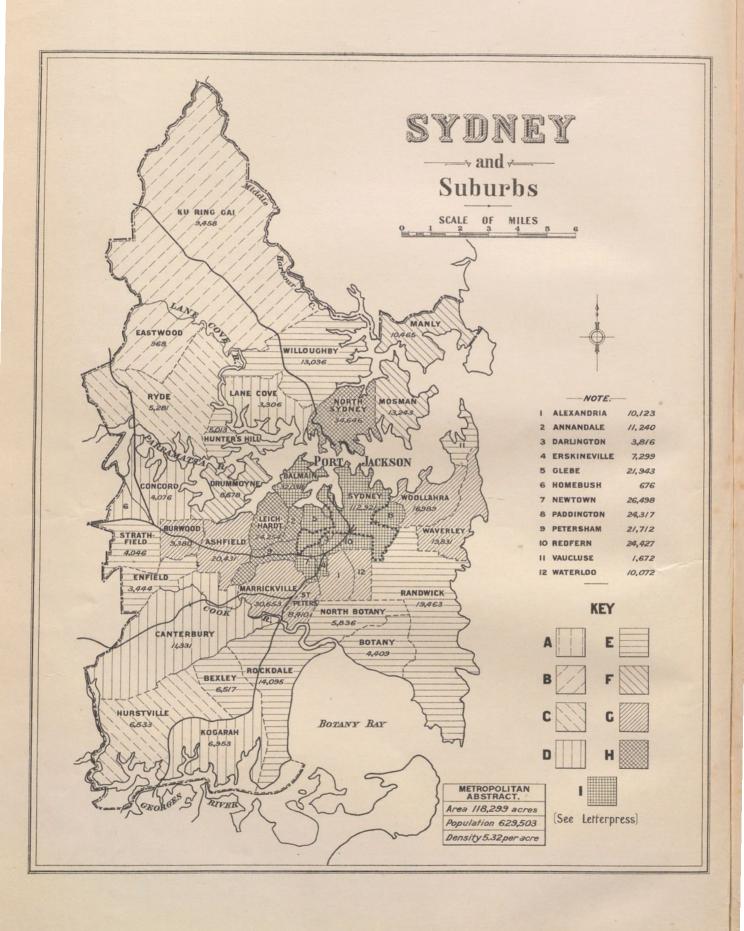
The area, population, and occupied dwellings of the several Statistical Districts of Western Australia are shewn in the following table:—

Area, Population and Occupied Dwellings of Western Australian Statistical Districts, 1911.

	AREA.	Р	OPULATION		Persons	Occupied	Occupied Dwellings per	Popula- tion per
STATISTICAL DISTRICT.	Square Miles.	Males.	Females.	Persons.	Square Mile.	Dwellings.	Square Mile.	Occupied Dwelling.
Beverley	3,750	2,160	1,280	3,440	.92	888	.237	3.83
Coolgardie	25,312	22,285	17,325	39,610	1.56	11,221	.443	3.53
Coolgardie, North	33,750	2,636	1,395	4,031	.12	1,438	.043	2.76
Esperance	29,840	271	164	435	.01	128	.004	3.27
Eucla	41,152	38	17	55	.001	15	.0004	3.47
Gascoyne	92,900	1,092	408	1,500	.02	320	.003	4.21
Katanning	3,750	2,822	1,913	4,735	1.26	1,110	.296	4.22
Kimberley, East	78,414	324	34	358	.005	135	.002	2.28
Kimberley, West	58,880	1,173	431	1,604	.03	433	.007	3.60
Magnet	25,312	2,794	1,540	4,334	.17	1,371	.054	3.09
Margaret	33,750	3,303	1,627	4,930	.15	1,855	.055	2.62
Murchison	24,480	1,591	568	2,159	.09	714	.029	2.84
Murchison, East	33,750	1,847	731	2,578	.08	1,100	.033	2.25
Narrogin	3,750	2,366	1,446	3,812	1.02	1,063	.283	3.57
Northam	13,125	9,730	5,706	15,436	1.18	4,250	.324	3.59
North West	117,344	2,557	479	3,036	.03	953	.008	2.60
Phillips River	13,375	1,022	580	1,602	.12	544	.041	2.91
Pingelly	3,750	2,263	1,403	3,756	1.00	912	.243	4.10
Plantagenet	7,289	3,383	2,991	6,374	.87	1,489	.204	4.27
Sussex	4,746	5,642	3,850	9,492	2.00	2,703	.570	3.51
Swan	4,052	59,238	58,000	117,238	28.93	24,549	6,058	4.77
Tambellup	3,750	1,224	730	1,954	.52	533	.142	3.64
Victoria	40,118	7,915	5,046	12,961	.32	2,894	.072	4.39
Wagin	3,750	2,439	1,517	3,956	1.05	1,063	.283	3,71
Wellington	2,716	9,059	6,867	15,926	5.86	4,232	1.558	3.75
Yilgarn	16,875	2,968	982	3,950	.23	1,708	.101	2.27
York	3,750	3,577	2,259	5,836	1.56	1,249	,333	4.62
Outside Statistical								•
Districts	252,490						•••	
	057.000	155 510	110.050	057.000		60 050	051	3.96
WHOLE STATE	975,920	155,719	119,379	275,098	.28	68,870	.071	
Shipping	•••	5,846	1,170	7,016	• •	•••	•••	•••
TOTAL POPULATION		161,565	120,549	282,114				

<sup>(</sup>vii.) Tasmania.—The Census map of Tasmania facing p. 431 shews the boundaries of each of the municipalities into which that State is divided. The position and name of the principal town is also shewn in each case, as well as the principal lines of railway in the State. The population of each municipality is given on the map, and the density is indicated in accordance with the scale on p. 425. The more densely populated municipalities of Hobart and Launceston and those in their immediate vicinity are shewn on a larger scale as insets, owing to the insufficiency of space for appropriate display of particulars on the map of the whole State. King Island and the Macquarie Islands, owing to their remoteness, are also shewn as insets, with other points necessary for indicating their relative positions. The following table gives the area, population, and occupied dwellings of each of the Municipalities of Tasmania:—





Area, Population and Occupied Dwellings of Tasmanian Municipalities, 1911.

		AREA.	P	OPULATION		Persons per	Occupied	Occupied Dwellings	Popula tion pe
MUNICIPALITY	•	Square Miles.	Males.	Females.	Persons.	Square Mile.	Dwellings.	per Square Mile.	Occupie Dwellin
Beaconsfield		214.06	2,323	2,233	4,556	21.28	981	4,583	4.6
Bothwell		990.63	738	619	1,357	1.37	308	.311	4.4
Brighton		179.69	998	943	1,941	10.80	423	2,354	4.5
Bruni	• •	140.62	347	300	647	4.60	138	981	4.6
Campbell Town		543.75	745				339	.623	
Circular Head	• •	1818.75		781	1,526	2.81			4.5
~-	• •		2,458	1,811	4,269	2.35	964	.530	4.4
	• •	110.16	1,200	1,282	2,482	22.53	533	4.838	4.6
Deloraine	• •	1245.31	3,053	2,726	5,779	4.64	1,116	.896	5.1
Devonport Emu Bay		$\begin{array}{ c c c c }\hline 42.66 \\ 208.59 \\ \hline \end{array}$	$\substack{2,321 \ 2,307}$	$2,538 \ 2,197$	$\frac{4,859}{4,504}$	$\begin{array}{c c} & 113.90 \\ & 21.59 \end{array}$	994 858	23.301 4,113	$oxed{4.8} \ 5.2$
Fanoranaa		2235.94	9 120	1 700	9 0 9 0	1 70	709	955	10
Esperance Evandale	• •	512.19	2,130	1,708	3,838	1.72	$\begin{array}{c} 793 \\ 381 \end{array}$	.355	$\frac{4.8}{5.1}$
	• •	1031.41	991	961	1,952	3.81		.744	
	• •		1,925	1,755	3,680	3.57	784	.760	4.6
Flinders Island		814.06	366	250	616	.76	143	.176	4.3
George Town	• •	239.06	$\frac{521}{276}$	519	1,040	4.35	250	1.046	4.1
Glamorgan	• •	615.62	376	335	711	1.15	155	.252	4.5
Glenorchy	• •	43.75	1,650	1,743	3,393	77.55	730	16.685	4.6
Gormanston	• •	1114.06	1,217	792	2,009	1.76	498	.447	4.0
Green Ponds	• •	172.66	550	573	1,123	6.50	242	1.402	4.6
Hamilton	•••	2240.62	1,153	983	2,136	.95	452	.202	4.7
Hobart		4.19	12,806	14,720	27,526	6569.45	5,504	1313.604	5.0
Huon	• •	306.25	1,930	1,687	3,617	11.81	761	2.485	4.7
Kentish	• •	451.56	2,963	2,608	5,571	12.34	1,045	2.314	5.3
Kingborough	• •	106.25	970	907	1,877	17.67	441	4.151	4.2
King Island	• •	425.00	482	284	766	1.80	197	.464	3.8
Latrobe	• •	210.47	1,777	1,731	3,508	16.67	698	3.316	5.0
Launceston		8.91	9,606	11,148	20,754	2329.29	4,221	473,737	4.9
Leven	• •	187.50	2,844	2,606	5,450	29.07	1,047	5.584	5.2
Lilydale	• •	332.81	1,478	1,313	2,791	8.39	609	1.830	3.3
Longford	• •	398.00	2,060	2,095	4,155	10.44	841	2.113	6.8
New Norfolk		510.94	3,208	2,916	6,124	11.99	1,270	2.486	4.8
New Town		9.06	$1,\!532$	1,850	3,382	373.29	658	72.627	5.1
Oatlands		587.50	1,650	1,455	3,105	5.29	629	1.071	4.8
Penguin		189.06	1,398	1,230	2,628	13.90	511	2.703	5.1
Port Cygnet		131.25	1,832	1,657	3,489	26.58	727	5.539	4.8
Portland		607.81	1,131	817	1,948	3.20	425	.699	4.5
Queenborough		15.47	1,561	2,037	3,598	232.58	757	46.348	4.7
Queenstown		59.38	2,158	1,669	3,827	64.45	915	15.409	4,1
Richmond		225.00	944	854	1,798	7.99	386	1.716	4.6
Ringarooma		631.25	2,605	1,959	4,564	7.23	1,060	1.679	4.3
Ross		487.50	360	345	705	1.45	148	.304	4.7
St. Leonards		221.09	1,291	1,321	2,612	11.81	539	2.438	4.8
Scottsdale		404.69	1,337	1,254	2,591	6.40	541	1.337	4.7
Sorell		295.00	1,117	943	2,060	6.98	443	1.502	4.6
Spring Bay		442.19	415	336	751	1.70	161	.364	4.0
strahan		1468.75	526	485	1,011	.69	235	160	4.3
Table Cape		337.50	2,530	2,263	4,793	14.20	981	2.907	4.8
asman		193.75	644	527	1,171	6.04	248	1.280	4.
Varatah		892.19	1,413	933	2,346	2.63	558	.625	4.5
Westbury		360.16	2,013	1,960	3,973	11.03	841	2.335	4.
leehan		1201.56	3,081	2,645	5,726	4.77	1,546	1.287	3.
WHOLE STATE		26,215.63	97,031	93,604	190,635	7.27	40,025	1.527	4.
Shipping	• •		560	16	576		• •		••.
TOTAL POPULAT	ION		97,591	93,620	191,211			• •	

(viii.) Northern Territory.—The Census map of the Northern Territory facing p. 432 shews the boundaries of the five counties which have been constituted. The boundary lines shewn in the remainder of the Territory are those of the several Census Sub-districts into which this portion was divided for the purposes of collection. The populations of the counties and other sub-divisions are shewn on the map, and the densities are indicated by hatching in accordance with the scale shewn on p. 425.

Area, Population and Occupied Dwellings of Northern Territory Counties, 1911.

County.	AREA.	P	OPULATION	ī.	Persons	Occupied	Occupied Dwellings	Popula- tion per
COUNTY.	Square Miles.	Males.	Females.	Persons.	Square Mile.	Dwellings.	per Square Mile.  2 .001 3 .001 5 .009 1 .098	Occupied Dwelling
Disraeli	3,500	2	1	3	001	2	.001	1.50
Gladstone	7,800	7	4	11	.001	6	.001	1.83
Malmesbury	2,800	37	5	42	.015	25	.009	1.40
Palmerston	4,000	785	297	1,082	.271	391	.098	2.76
Rosebery	3,500	768	110	878	.251	409	.117	2.12
Remainder of Territory	502,020	$\bf 954$	159	1,113	.002	415	.001	2.30
WHOLE TERRITORY	523,620	2,553	576	3,129	.006	1,248	.002	2.36
Shipping		181	••	181		· .		••.
TOTAL POPULATION	· · ·	2,734	576	3,310				

(ix.) Sydney and Suburbs.—In the maps relating to the Metropolitan areas of the several States, the hatching to indicate density has been based on the number of persons per acre, or number of acres per person as the case may be, in accordance with the following scale:—

n 4 acres.	
acres to less than 1 on 2	acres.
	acre.
acre ,, 2 ,, 1	,,
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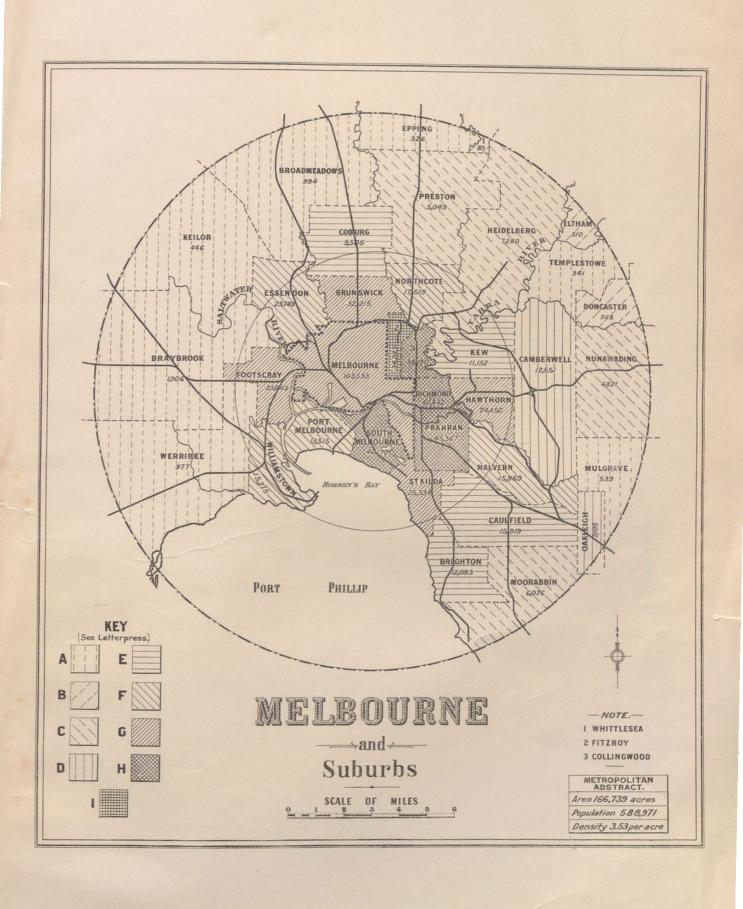
The Census map for Sydney and suburbs facing p. 433 shews the boundaries of the several municipalities and the shire included in the district which for Census purposes has been classed as the "Metropolitan Area" of New South Wales. The population of each is shewn on the map, and each is hatched to indicate density of population in accordance with the above scale. The principal railway lines are also shewn.

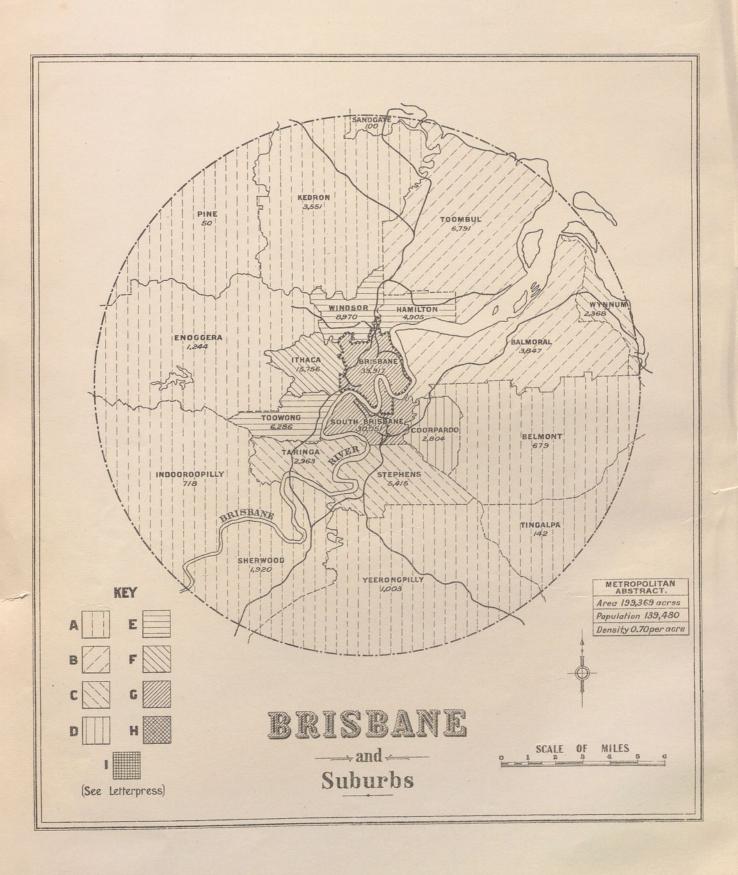
The area, population and occupied dwellings in each of the local government areas included in the metropolitan area are given in the following table:—

Area, Population and Occupied Dwellings of Metropolitan Local Government Areas of New South Wales, 1911.

Local Governm	ENT	AREA.	Pe	PULATION		Persons	No. of Occupied	Occupied Dwell-	Popula- tion per
AREA.	.12111	Acres.	Males.	Females.	Persons.	per Acre.	Dwell- ings.	ings per Acre.	Occupied Dwelling.
Alexandria	(M)	1,024	5,260	4,863	10,123	9.89	2,244	2.191	4.51
	(M)	360	5,413	5.827	11,240	31.22	2,363	6.564	4.76
	(M)	2,081	9.212	11,219	20,431	9.82	4,189	2.013	4.88
	(M)	932	15,907	16,131	32,038	34.38	6,464	6.936	4.96
Balmain	(M)	1,920	3,096	3,421	6,517	3.39	1,405	.732	4.64
Bexley	(M)	2,163	2,355	2,054	4,409	2.04	896	.414	4.92
Botany	(M)	2,103	3,083	2,753	5,836	2.59	1,271	.563	4.59
Botany, North		1,050	4,001	5,379	9,380	8.93	1,843	1.755	5.09
Burwood	(M)	8,384	5,628	5,707	11,335	1.35	2,329	.278	4.87
Canterbury	(M)	$\frac{0,364}{2,666}$	2.009	2,067	4,076	1.53	844	.317	4.83
Concord	(M)		1,863	1.953	3,816	86.73	745	16.932	5.12
Darlington	(M)	$\begin{array}{c c} 44 \\ 1.920 \end{array}$	4,182	4.496	8,678	4.52	1,902	.991	4.56
Drummoyne	(M)		521	447	968	.33	219	.075	4.42
Eastwood	(M)	2,931	1,695	1.749	3,444	2.03	718	.423	4.80
Enfield	(M)	1,696		3,716	7.299	43.97	1,551	9.343	4.71
Erskineville	(M)	166	3,583	11,493	21,943	42.12	4,202	8.065	5.22
Glebe	(M)	521	10,450	321	676	1.06	137	.214	4.93
Homebush	(M)	640	355	2,408	5,013	3.78	693	.523	7.23
Hunters' Hill	(M)	1,325	2,605		6,533	.97	1,434	.212	4.56
Hurstville	(M)	6,750	3,187	3,346	6,953	1.56	1,524	.343	4.56
Kogarah	(M)	4,448	3,429	3,524	9,458	.41	1,884	.082	5.02
Ku Ring Gai.	(S)	23,040	4,347	5,111	3,306	1.32	656	.263	5.04
Lane Cove	(M)	2,496	1,639	1,667	24,254	20.73	4,909	4.196	4.94
Leichhardt	$(\mathbf{M})$	1,170	11,828	12,426	10,465	4.31	1,853	.764	5.65
Manly	(M)	2,426	4,716	5,749	30,653	15.20	6.514	3.231	4.71
Marrickville	(M)	2,016	14,338	16,315	13,243	6.41	2,687	1.300	4.93
Mosman	$(\mathbf{M})$	2,067	5,836	7,407	26,498	59.95	5,377	12.165	4.93
Newtown	$(\mathbf{M})$	442	12,887	13,611	20,498 $24,317$	60.34	4,666	11.578	5.21
Paddington	(M)	403	11,494	12,823	24,317	17.31	4,479	3.572	4.85
Petersham	$(\mathbf{M})$	1,254	9,846	11,866		2.41	3,913	.485	4.97
Randwick	$(\mathbf{M})$	8,064	9,294	10,169	19,463	56.15	4,436	10.198	5.51
$ m Redfern \qquad \dots$	$(\mathbf{M})$	435	12,422	12,005	24,427 14.095	2.81	2,931	.584	4.81
Rockdale	(M)	5,022	6,739	7,356		.74		.162	4.59
Ryde	$(\mathbf{M})$	7,110	2,562	2,719	5,281	9.39	1,678	1.873	5.01
St. Peters	$(\mathbf{M})$	896	4,220	4,190	8,410	2.26	809	.451	5.00
Strathfield	$(\mathbf{M})$	1,792	1,709	2,337	4,046	33.94		5.549	6.12
Sydney	(M)	3,327	59,685	53,236	112,921	16.76		3.483	4.81
Sydney North	(M)	2,067	15,625	19,021	34,646	2.18		.422	5.16
Vaucluse	(M)	768	768	904	1,672	12.50			4.86
Waterloo	(M)	806	5,206	4,866	10,072	10.09		2.143	1
Waverley	$(\mathbf{M})$	1,965	9,107	10,724	19,831	2.36	1 '		4.97
Willoughby	(M)	5,530	6,211	6,825	13,036	8.82			
Woollahra	(M)	1,926	7,415	9,574	16,989	- 8.82	3,424	1.770	- 1.00
Total Metropoli Area	tan 	118,299	305,728	323,775	629,503	5.32	123,234	1.042	5.11

In the foregoing table those areas marked (M) are Municipalities, while that marked (S) is a Shire. In the case of New South Wales the area adopted for Census and Statistical purposes as "Metropolitan," comprises the whole area of the municipalities and the shire specified. In all the other States the "Metropolitan Area" boundary crosses the boundaries of several of the constituent Local Government Areas.





(x.) Melbourne and Suburbs.—The Census map of Melbourne and Suburbs facing p. 434 shews the boundaries of the several Cities, Towns, Boroughs, Shires or parts thereof of which constitute the "Metropolitan Area" adopted in Victoria for Census and Statistical purposes. The population of each Local Government area or part thereof so included is shewn on the map, and the density of the population of each is indicated thereon in accordance with the scale shewn on p. 434. The principal railway lines are also shewn. In this case the Metropolitan Area is a circle of ten miles radius, having the General Post Office, Melbourne, as its centre.

The area, population and occupied dwellings in each of the local government areas which are wholly or in part included in the metropolitan area are shewn in the following table. In each case the total area, population and occupied dwellings for the local government area are given, an indication being made in the table of those cases in which a part only of such total is used in compiling the "Metropolitan" total given at the foot of the table. Similarly in the Census map the hatching relates to the density of population of the whole of the Local Government area in question not to that portion of it included in the map.

Area, Population and Occupied Dwellings of Metropolitan Areas of Victoria, 1911.

		AREA.	P	OPULATION	:	Persons	No. of Occupied	Occupied Dwell-	Popula- tion per
Local Governm Area.	ENT	Acres.	Males.	Females.	Persons.	per Acre.	Dwell- ings.	ings per Acre.	Occupied Dwelling.
Braybrook 1	(S)	58,880	1,269	1,104	2,373	.04	491	.008	4.83
Brighton	(M)	3,288	5,405	6,678	12,083	3.67	2,508	.763	4.82
Broadmeadows 1	(S)	47,360	1,037	1,063	2,100	.04	388	.008	5.41
Brunswick	(M)	2,722	15,426	16,789	32,215	11.84	6,696	2.460	4.81
Camberwell	(M)	8,320	5,635	6,916	12,551	1.51	2,631	.316	4.77
Caulfield	(M)	6,080	7,246	8,673	15,919	2.62	3,393	.558	4.69
Coburg	(M)	4,800	4,753	4,752	9,505	1,98	1,871	.390	5.08
Collingwood	(M)	1,139	15,986	18,204	34,190	30.02	7,160	6.286	4.78
Doncaster 1	(S)	8,640	651	544	1,195	.14	245	.028	4.88
Eltham 1	(S)	138,240	1,756	1,667	3,423	.02	812	.006	4.22
Epping 1	(S)	51,840	683	615	1,298	.03	238	.005	5.45
Essendon	(M)	4,000	11,037	12,712	23,749	5.94	4,952	1.238	4.80
Fitzroy	(M)	923	16,085	18,198	34,283	37.14	6,787	7.353	5.05
Footscray	(M)	2,577	11,906	11,737	23,643	9.17	4,757	1.846	4.97
Hawthorn	(M)	2,400	10,731	13,719	24,450	10.19	5,210	2.171	4.69
Heidelberg 1	(S)	26,240	4,094	4,516	8,610	.33	1,567	.060	5.49
Keilor <sup>1</sup>	(S)	33,920	. 502	420	922	.03	210	.006	4.39
Kew	(M)	3,553	5,064	6,088	11,152	3.14	2,045	.576	5.45
Malvern	(M)	4,000	$6,\!807$	9,162	15,969	3.99	3,329	.832	4.80
Melbourne	(M)	7,658	51,958	51,635	103,593	13.53	19,449	2.540	5.33
Melbourne, South	(M)	2,311	$22,\!060$	24,130	46,190	19.99	9,327	4.036	4.95
Moorabbin 1	(S)	20,480	6,113	6,644	12,757	.62	2,535	.124	5.03
Mulgrave 1	(S)	16,320	$1,\!226$	1,197	2,423	.15	494	.030	4.90
Northcote	(M)	2,850	8,431	9,088	17,519	6.15	3,654	1.282	4.79
Nunawading 1	(S)	15,040	3,413	3,707	7,120	.47	1,543	.103	4.61
Oakleigh 1	$(\mathbf{M})$	2,178	1,024	1,127	2,151	.99	486	.223	4.43
Port Melbourne	(M)	2,366	6,768	6,747	13,515	5.71	2,720	1.150	4.97
Prahran	(M)	2,320	19,469	25,898	45,367	19.55	9,880	4.259	4.59
Preston	(S)	8,800	2,457	2,592	5,049	.57	1,006	.114	5.02
Richmond	(M)	1,430	19,354	21,088	40,442	28.28	8,686	6.074	4.66
St. Kilda	(M)	2,049	10,877	14,457	25,334	12.36	5,040	2.460	5.03
Templestowe <sup>1</sup>	(S)	13,120	$\bf 544$	457	1,001	.08	230	.018	4.35
Werribee 1	(S)	176,000	2,030	1,703	3,733	.02	761	.004	4.91
Whittlesea $^1$	(S)	85,760	1,160	1,049	2,209	.03	419	.005	5.27
Williamstown	(M)	2,775	7,572	7,703	15,275	5.50	3,196	1,152	4.78
Total Metropol	litan								
Area <sup>2</sup>		166,739	277,956	311,015	588,971	3.53	119,562	.717	4.93

<sup>&</sup>lt;sup>1</sup> A part only of the figures here shewn is included in the Metropolitan total below.

In the above table the areas marked (M) are Cities, Towns, or Boroughs, and correspond with the areas classed as "Municipalities" in the case of New South Wales. The areas marked (S) are Shires. It will be noticed that with the exception of Oakleigh all the cities, towns, and boroughs included in this table are wholly within the "Metropolitan Area." On the other hand, with the exception of Preston, all the shires are included in part only.

(xi.) Brisbane and Suburbs.—The Census map of Brisbane and Suburbs facing p. 435 shews the boundaries of the several Cities, Towns, Shires, or parts thereof which are combined to form the "Metropolitan Area" as used in the case of Queensland for Census and Statistical purposes. The population of each Local Government area or part thereof so included is shewn on the map, and the density of population of each is indicated by hatching in accordance with the scale given on p. 434. In cases where a part only of a district is included in the map, the density indicated by the hatching relates to the whole area of the district. The area represented is a circle of ten miles radius from the General Post Office, Brisbane. The principal railway lines are shewn in the map.

The area, population and occupied dwellings in each of the local government areas which are wholly or in part included in the Queensland Metropolitan area are given in the following table, and an indication is made of those cases in which the particulars are included in part only in the metropolitan total:—

<sup>&</sup>lt;sup>2</sup> Exclusive of certain portions of the figures in respect of Local Government areas marked 1 above.

Area, Population and Occupied Dwellings of Metropolitan Local Government Areas of Queensland, 1911.

Local Govern	MENT	AREA.	P	OPULATION	•	Persons	No. of Occupied	Occupied Dwell-	Popula- tion per
AREA.		Acres.	Males.	Females. Persons.		per Acre.	Dwell- ings.	ings per Acre.	Occupied Dwelling
Balmoral	(S)	15,360	1,974	1,873	3,847	.25	846	.055	4.55
Belmont 1	(S)	17,280	385	319	704	.04	179	.010	3.93
Brisbane	$(\mathbf{M})$	3,520	19,612	20,305	39,917	11.34	6,384	1.814	6.25
Brisbane, South	( <b>M</b> )	2,880	14,326	15,725	30,051	10.43	6,916	2.401	4.35
Coorparoo	(S)	2,560	1,385	1,419	2,804	1.13	613	.239	4.57
Enoggera 1	(S)	26,240	661	597	1,258	.05	268	.010	4.69
Hamilton	(M)	1,920	2,334	2,571	4,905	2.55	985	.513	4.98
Indooroopilly 1	(S)	35,200	466	431	897	.03	176	.005	5.10
Ithaca	$(\mathbf{M})$	2,880	7,546	8,210	15,756	5.47	3,206	1.113	4.9
$Kedron 1 \dots$	(S)	27,520	1,999	1,664	3,663	.13		.026	5.21
Pine 1	(S)	151,680	1,414	1,217	2,631	.02	480	.003	5.48
Sandgate 1	(M)	3,840	1,323	1,728	3,051	.79		.145	5.48
Sherwood 1	(S)	12,800	1,729	1,596	3,325	.26		.031	8.46
Stephens	(S)	5,760	2,642	2,773	5,415	.94			4.65
Taringa	(S)	3,520	1,355	1,608	2,963	.84	614	.174	4.83
Tingalpa 1	(S)	76,800	665	597	1,262	.02	261	.003	4.8
Toombul	(S)	17,920	3,243	3,548	6,791	.38		.070	5.4
Toowong	(M)	2,880	2,949	3,337	6,286	2.18	1,306	.453	
Windsor	(M)	2,560	4,219	4,751	8,970	3.50		. 739	4.74
Wynnum 1	(S)	3,840	1,506	1,715	3,221	.84		.159	5.20
Yeerongpilly 1	•(S)	112,000	680	633	1,313	.01	283	.025	4.64
Total, Metropo	litan						25.500	100	
Area $^2$	٠.,	199,369	67,628	71,852	139,480	.70	27,532	.138	5.0

A part only of the figures here shewn is included in the Metropolitan total below.

In the above table, Cities and Towns are marked (M), while Shires are marked (S). With the exception of Sandgate, all the Cities and Towns in the table are wholly within the "Metro-In the case of the Shires, five are wholly within the area, while nine are included politan Ārea.' in part only.

(xii.) Adelaide and Suburbs.—The Census map of Adelaide and Suburbs facing page 436 shews the boundaries of the several local government areas or parts thereof which are grouped together to form the "Metropolitan Area" of South Australia for Census purposes. In South Australia the districts which are known as Municipalities, Cities, Towns or Boroughs in certain other States are officially referred to as "Corporations," while the local governing authorities corresponding to "Shire Councils" in other States are here known as "District Councils." The population of each such area or part thereof is shewn on the map, and the density of population is indicated by a system of hatching in accordance with the scale on p. 434. Where a part only of a district is included the hatching relates to the density of the whole district.

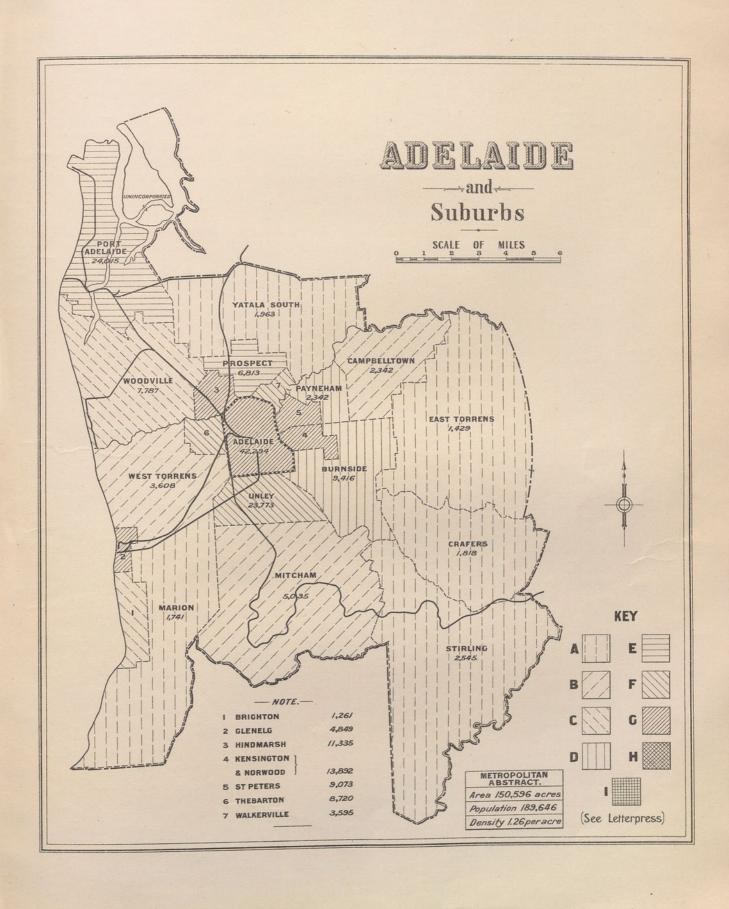
The area, population and occupied dwellings in each local government area included wholly or in part in the metropolitan total for South Australia are given in the following table. Cases of partial inclusion are indicated by note:-

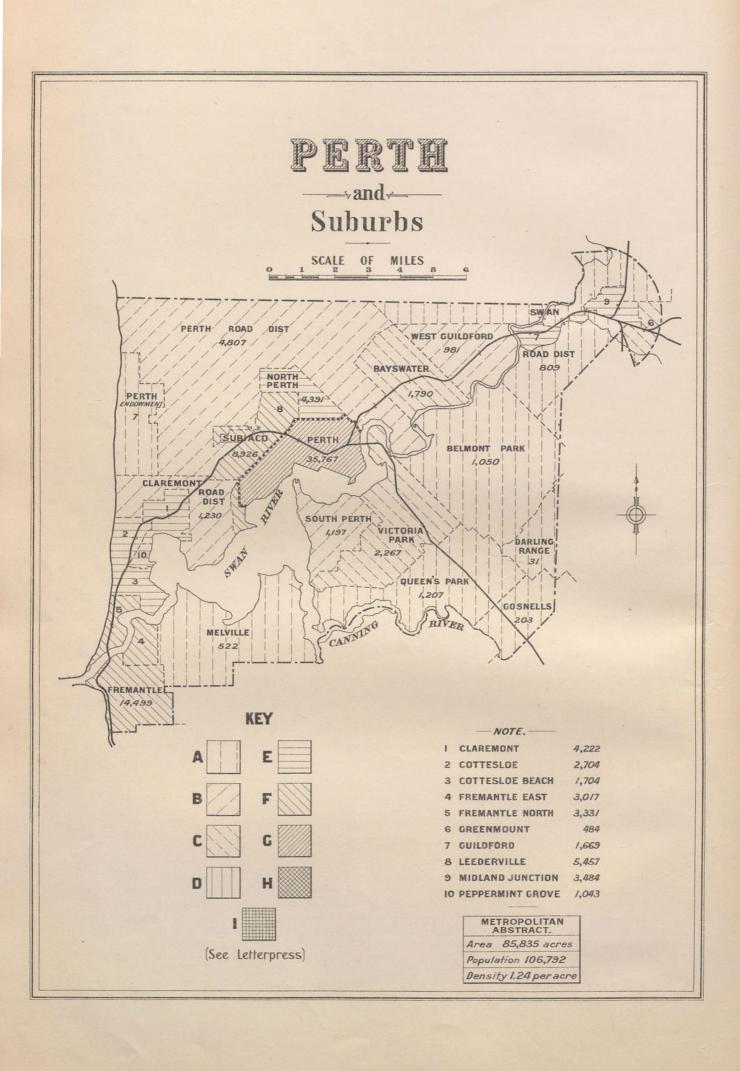
Area, Population and Occupied Dwellings of Metropolitan Local Government Areas of South Australia, 1911.

Local Government	AREA.	P	OPULATION		Persons	No. of Occupied	Occupied Dwell-	Popula- tion per Occupied Dwelling.
AREA.	Acres.	Males.	Females.	Persons.	Acre.	Dwell- ings.	ings per Acre.	
Adelaide (M)	3,778	20,680	21,614	42,294	11.19	8,182	2.166	5.17
Brighton (M)	1.970	588	673	1,261	.64	359	.131	4.87
Burnside (D'C)	6,080	4,441	4.975	9,416	1.55	1,782	.293	5.28
Campbelltown (D C)	5,760	1,184	1,158	2,342	.41	515	.089	4.55
Crafers (D C)	10,560	881	937	1,818	.17	400	.038	4.55
Glenelg (M)	532	2,110	2,739	4,849	9.11	923	1.735	5.25
Hindmarsh (M)	1,208	5,676	5,659	11,335	9.38	2,338	1.935	4.85
Kensington and	/	-,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Í				
Norwood (M)	980	6,351	7,541	13,892	14.18	3,003	3.064	4.63
Marion (D'C)	13,766	864	877	1,741	.13	360	.026	4.84
Mitcham (D C)	17,600	2,401	2,634	5,035	.29	1,045	.059	4.82
Payneham . (D C)	1,760	1,121	1,221	2,342	.13	516	.293	4.54
Port Adelaide (M)	8.870	11,974	12,041	24,015	2.71	4,861	.548	4.94
Prospect (D'C)	2,240	3,163	3,650	6,813	3.04	1,486	.663	4.58
St. Peters (M)	922	4,099	4,974	9,073	9.84	1,884	2.043	4.82
Stirling (D`C)	19.840	1,143	1,402.	2,545	.13	571	.029	4.46
Thebarton (M)	1,112	4,264	4,456	8,720	7.84	1,805	1.623	4.83
Torrens, East 1 (D'C)	25,920	951	813	1,764	.07	364	.014	4.85
Torrens, West (D C)	8,320	1,813	1,795	3,608	.43	731	.088	4.94
Unlev (M)	3,525	10,791	12,982	23,773	6.74	5,038	1.429	4.72
Walkerville (D'C)	602	1,552	2.043	3,595	5.98	781	1.298	4.60
Woodville (D C)	10,240	3,735	4,052	7,787	.76	1,556	.151	5.00
Yatala, South (D C)	11,200	1,070	893	1,963	.18	406	.036	4.83
Total, Metropolitan	150,596	90,578	99,068	189,646	1.26	38,742	.257	4.89

<sup>&</sup>lt;sup>2</sup> Exclusive of certain portions of the figures in respect of Local Government areas marked 1 above.

A part only of the figures here shewn is included in the Metropolitan total below.
 Exclusive of certain portions of the figures in respect of Local Government areas marked <sup>1</sup> below.





In the above table the areas marked (M) are under the control of municipal "corporations," while those marked (D C) are controlled by "District Councils." In all cases except that of East Torrens the whole of local government area specified has been included in the metropolitan area.

(xiii.) Perth and Suburbs.—The Census map of Perth and Suburbs facing p. 437 shews the boundaries of each of the municipalities and road districts or parts thereof combined to form the "Metropolitan" Area of Western Australia for Census purposes. The population of each of these areas or parts is shewn on the map, and the density of population is indicated by hatching in accordance with the scale given on p. 434. Where a part only of a district is shewn the hatching relates to the density of population of the whole district.

The area, population, and occupied dwellings in each local government area included wholly or in part in the metropolitan total for Western Australia are given in the following table. Cases of partial inclusion are indicated by note:—

Area, Population, and Occupied Dwellings of Metropolitan Local Government Areas of Western Australia,
1911.

Local Government Area.	AREA.	POPULATION.			Persons	No. of Occupied	Occupied Dwell-	Popula- tion per
		Males.	Females.	Persons.	per Acre.	Dwell- ings.	ings per Acre.	
Bayswater (R D)	2,880	924	866	1,790	.62	417	.145	4.29
Belmont Park 1 (R D)	8,320	601	487	1,088	.13	271	.033	4.01
Claremont (M)	1,164	1,919	2,303	4,222	3.63	860	.739	4.91
Claremont (R'D)	3,520	773	457	1,230	.35	184	.052	6.68
Cottesloe (M)	992	1,261	1,443	2,704	2.73	541	.545	5.00
Cottesloe Beach (R D)	800	807	897	1,704	2.13	381	.476	4.47
Darling Range 1 (R D)	147,200	561	477	1,038	.01	245	.002	4.24
Fremantle (M)	2,755	7,545	6,954	14,499	5.26	2,988	1.085	4.85
Fremantle East (M)	755	1,464	1,553	3,017	4.00	673	.891	4.48
Fremantle North (M)	794	1,662	1,669	3,331	4.20	691	.870	4.82
Gosnells 1 (R`D)	27,680	375	362	737	.03	191	.007	3.86
Greenmount 1 (R D)	154,880	1,487	1,229	2,716	.02	688	.004	3.95
Guildford (M)	579	796	873	1,669	2.88	366	.632	4.56
Guildford, West (R D)	3,200	489	492	981	.31	211	.066	4.65
Leederville (M)	1,042	2,524	2,933	5,457	5.24	1,246	1,196	4.38
Melville 1 (R D)	12,800	292	273	565	.04	123	.010	4.59
Midland Junction (M)	1,378	1,763	1,721	3,484	2.53	739	.536	4.71
PeppermintGrove(R D)	320	427	616	1,043	3.26	204	.638	5.11
Perth (M)	3,575	18,118	17,649	35,767	10.00	6,858	1.918	5.22
Perth <sup>1</sup> $(R D)$	26,880	2,654	2,412	5,066	.19	854	.031	5.93
Perth North (M)	1,296	2,110	2,281	4,391	3.39	1,018	.785	4.31
Perth South (M)	2,501	600	597	1,197	.48	272	.109	4.40
Queen's Park (M)	7,130	668	539	1,207	.17	251	.035	4.81
Subiaco (M)	1,420	4,163	4,763	8,926	6.29	2,055	1.447	4.34
Swan 1 (R D)	224,640	1,082	747	1,829	.01	378	.002	4.84
Victoria Park (M)	3,942	1,083	1,184	2,267	.58	546	.139	4.15
Total, Metropolitan								
Area 2	85,835	53,231	53,561	106,792	1.24	21,897	.255	4.88

<sup>&</sup>lt;sup>1</sup> A part only of the figures here shewn is included in the Metropolitan total below.

In the above table, municipalities are marked (M), and road districts, which correspond to Shires in certain other States, are marked (R D). All of the municipalities mentioned are wholly included in the metropolitan total. Of the twelve road districts mentioned five are wholly included, while seven are included in part only.

(xiv.) Hobart and Suburbs.—In the Census map of Hobart and Suburbs facing p. 438 are shewn the boundaries of the municipalities and parts thereof which go to make up the area adopted for Census purposes as the "Metropolitan Area" of Tasmania. The population of each district or part is shewn on the map, and the density of population of each is indicated by hatching in accordance with the scale shewn on p. 434. Where a part only of a municipality is shewn the density hatching relates to the whole municipality. In Tasmania all the local government areas whether urban or rural are now known as "Municipalities."

The area, population and occupied dwellings in each municipality included wholly or in part in the metropolitan total for Tasmania are given in the following table. Cases of partial inclusion are indicated by note:—

<sup>&</sup>lt;sup>2</sup> Exclusive of certain portions of the figures in respect of Local Government areas marked 1 above.

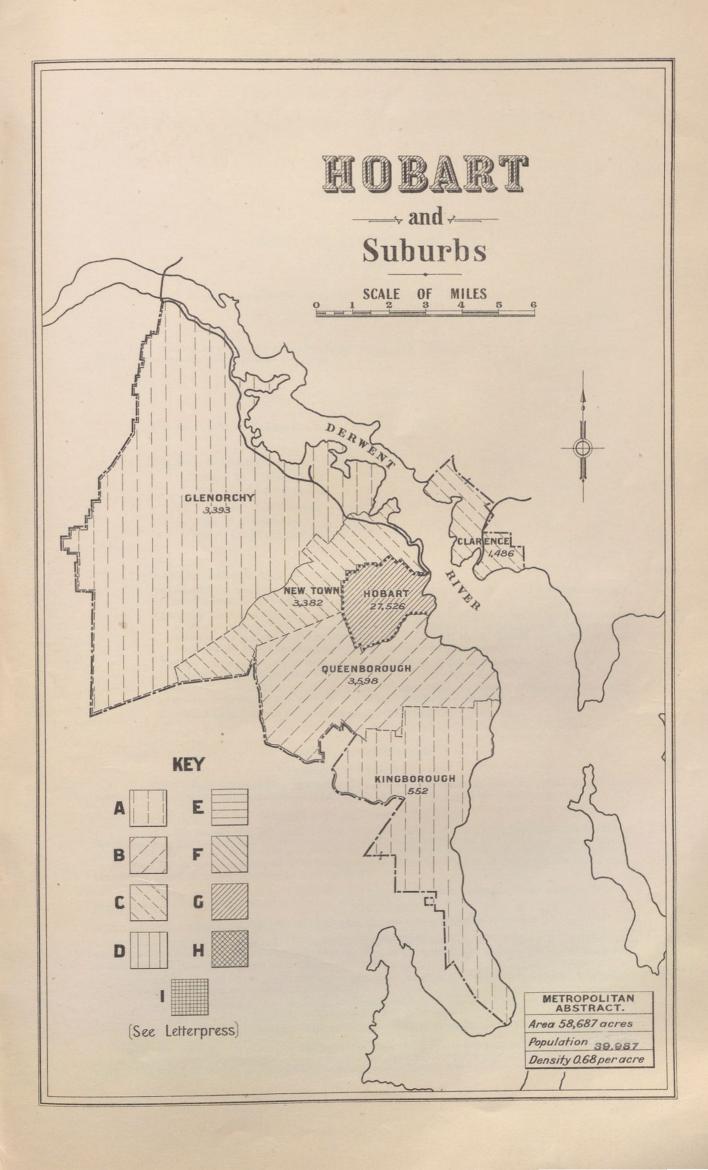
Area, Population and Occupied Dwellings of Metropolitan Municipalities of Tasmania, 1911.

Municipality.	AREA.	POPULATION.			Persons	No. of Occupied	Occupied Dwell-	Popula- tion per
	Acres.	Males.	Females.	Persons.	per Acre.	Dwell- ings.	ings per Acre.	Occupied Dwelling.
O1 - 1	70 500	1,200	1,282	2,482	.04	533	.008	4.66
Clarence 1	70,502   28,000	1,200	1,743	3,393	.12	730	.026	4.64
Glenorchy Hobart	2,682	12,806	14,720	27,526	10.26	5,504	2.053	5.00
Kingborough 1	68,000	970	907	1.877	.03	441	.006	4.25
New Town	5.798	1,532	1,850	3,382	.58	658	.113	5.14
Queenborough	9,901	1,561	2,037	3,598	.36	757	.072	4.75
Total Metropolitan Area 2	58,687	18,487	21,450	39,937	.68	8,082	.138	4.94

<sup>&</sup>lt;sup>1</sup> A part only of the figures here shewn is included in the Metropolitan total below.

Of the six municipalities mentioned above, four were wholly and two partially included in the metropolitan area.

<sup>&</sup>lt;sup>2</sup> Exclusive of certain portions of the figures in respect of Local Government areas marked <sup>1</sup> above.



# APPENDIX 1.

# CENSUS AND STATISTICS ACT 1905.

No. 15 of 1905.

An Act relating to the Census and Statistics of the Commonwealth.

[Assented to 8th December, 1905]

Be it enacted by the King's Most Excellent Majesty, the Senate, and the House of Representatives of the Commonwealth of Australia as follows:—-

#### PART I .-- INTRODUCTORY.

#### SHORT TITLE.

1. This Act may be cited as the Census and Statistics Act 1905.

#### PARTS.

2. This Act is divided into parts, as follows:-

Part I .- Introductory.

Part II.—Administration.

Part III.—The Census.

Part IV .- Statistics.

Part V.-Miscellaneous.

#### DEFINITIONS.

- 3. In this Act, unless the contrary intention appears-
  - "Commissioner for Affidavits" means a person authorised under the law of the Commonwealth or of a State to take affidavits or declarations.
  - "Dwelling" means a building, erection, or tenement, whether permanent or temporary, which is wholly or partly used for the purpose of human habitation and includes any ship or other vessel in any port of the Commonwealth or in any inland waters thereof, or any ship or vessel registered in Australia on a passage between any two Commonwealth ports.
  - "Factory" means any work, mill, or establishment used for the purpose of manufacturing, treating, or preparing any article.
  - "Occupier" includes every governor, superintendent, officer in charge, or keeper, of any gaol, prison, hospital, lunatic asylum, or public or charitable institution.
  - "The Statistician" means the Commonwealth Statistician.

# PART II .-- ADMINISTRATION.

# APPOINTMENT OF STATISTICIAN.

4. The Governor-General may appoint a Commonwealth Statistician, who shall have such powers and perform such duties as are conferred or imposed on him by this Act or the regulations.

# Power of Statistician to Delegate.

- 5.—(1.) The Statistician, in relation to any particular matters or class of matters or to any particular State or part of the Commonwealth, with the approval of the Minister, may, by instrument under his hand, delegate any of his powers under this Act (except this power of delegation) so that the delegated powers may be exercised by the delegate with respect to the matters or class of matters or the State or part of the Commonwealth specified in the instrument of delegation.
- (2.) Every delegation shall be revocable in writing, at will, and no delegation shall affect the exercise or performance by the Statistician of any power or duty.

# ARRANGEMENTS WITH STATE GOVERNMENTS AS TO EXECUTION OF ACT.

- 6.—(1) The Governor-General may enter into any arrangement with the Governor of any State providing for any matter necessary or convenient for the purpose of carrying out or giving effect to this Act and in particular for all or any of the following matters:—
  - (a) The execution by State Officers of any power or duty conferred or imposed on any officer under this Act or the regulations;
  - (b) The collection by any State Department or officer of any statistical or other information required for the purpose of carrying out this Act; and
  - (c) The supplying of statistical information by any State Department or officer to the Statistician.
- (2.) All State Officers executing any power or duty conferred or imposed on any officer under this Act or the regulations, in pursuance of any arrangement entered into under this section, shall for the purposes of the execution of that power or duty be deemed to be officers under this Act.

#### DECLARATION OF SECRECY BY OFFICERS.

7. Every officer executing any power or duty conferred or imposed on any officer under this Act or the regulations, shall, before entering upon his duties or exercising any power under this Act, make before a Justice of the Peace or Commissioner for Affidavits a declaration in accordance with the prescribed form.

# PART III .--- THE CENSUS.

#### TAKING OF CENSUS.

- 8.—(1.) The Census shall be taken in the year One thousand nine hundred and eleven, and in every tenth year thereafter.
  - (2.) The Census Day shall be a day appointed for that purpose by proclamation.

#### STATISTICIAN TO TAKE STEPS FOR COLLECTION OF CENSUS.

It shall be the duty of the Statistician, subject to the regulations and to the directions of the Minister, to prepare and issue forms and instructions, and take all necessary steps for the taking and collection of the Census

#### FORMS TO BE LEFT AT DWELLINGS.

- 10.—(1.) For the purpose of taking the Census, a form called the Householder's Schedule shall be prepared, and left, in accordance with the regulations, at every dwelling throughout the Commonwealth.
- Where a dwelling is let, sublet, or held in different apartments and occupied by different persons or families, each part so let, sublet, or held and used for the purpose of human habitation shall be deemed a dwelling house.

#### OCCUPIERS TO FILL UP HOUSEHOLDERS' SCHEDULES.

11. Every occupier of a dwelling, with or for whom a Householder's Schedule has been left, shall to the best of his knowledge and belief, fill up and supply therein, in accordance with the instructions contained in or accompanying the Schedule, all the particulars specified therein, and shall sign his name thereto and shall deliver the Schedule so filled up and signed to the Collector authorized to receive it. Penalty: Ten pounds.

#### PARTICULARS IN SCHEDULE.

- 12. The particulars to be specified in the Householder's Schedule shall include the particulars following:
  - (a) the name, sex, age, condition as to, and duration of, marriage, relation to head of the household, profession or occupation, sickness or infirmity, religion, education, and birthplace, and (where the person was born abroad) length of residence in Australia and nationality of every person abiding in the dwelling during the night of the Census Day;
    (b) the material of the dwelling and the number of rooms contained therein;

  - (c) any other prescribed matters.

# COLLECTORS TO ASSIST IN FILLING UP SCHEDULES.

13. It shall be the duty of each Collector if requested to assist occupiers of dwelling houses in filling up the Householder's Schedule, and to satisfy himself by inquiries from occupiers of dwellings or other persons that the Householder's Schedule has been correctly filled up.

# DUTY OF PERSONS TO SUPPLY INFORMATION TO COLLECTORS.

14. Every person shall, to the best of his knowledge and belief, answer all questions asked him by a Collector necessary to obtain any information required to be filled up and supplied in the Householder's schedule.

Penalty: Ten pounds.

# RETURNS OF PERSONS NOT ABIDING IN DWELLINGS.

15.—(1) The Statistician shall obtain such returns and particulars as are prescribed with respect to persons who, during the night of the Census Day were not abiding in any dwelling.

(2.) Every person shall, on being required by the Statistician so to do, furnish to the best of his know-

(2.) Every person shall, on being required by the Statistician so to do, iurnish to the bost of his liedge and belief any prescribed particulars relating to persons who were not abiding on the night of the Census Day in any dwelling.

Penalty: Ten pounds.

# PART IV .- STATISTICS.

# STATISTICS TO BE COLLECTED.

- 16. The Statistician shall, subject to the regulations and the directions of the Minister, collect, annually, statistics in relation to all or any of the following matters:-
  - Population;
  - Vital, social, and industrial matters;
  - Employment and non-employment; Imports and exports;

  - Inter-State trade; Postal and telegraphic matters;

  - Fostal and telegraphic matters;
    Factories, mines, and productive industries generally;
    Agricultural, horticultural, viticultural, dairying, and pastoral industries;
    Banking, insurance, and finance;
    Barking, insurance, and finance;
  - Railways, tramways, shipping, and transport;

  - Land tenure and occupancy; and Any other prescribed matters.

#### FORMS TO BE FILLED UP.

17. For the purpose of enabling the statistics referred to in this part of this Act to be collected, all prescribed persons shall, to the best of their knowledge, when required by the Statistician so to do, fill up and supply, in accordance with the instructions contained in or accompanying the prescribed form, the particulars specified in that form.

Penalty: Ten pounds.

#### Duty of Persons to Answer Questions.

18. Every person shall, to the best of his knowledge and belief, answer all questions asked him by the Statistician or an officer authorized in writing by the Statistician, necessary to obtain any information required for the purposes of any statistics authorized by this Act to be collected. Provided that no prosecution for contravention of this section shall be instituted without the consent of the Minister.

Penalty: Ten pounds.

#### POWERS OF ENTRY AND INSPECTION.

- 19.—(1.) For the purpose of making any inquiries or observations necessary for the proper carrying out of this Act, the Statistician or any officer authorized in writing by him may, at any time during working hours enter any factory, mine, workshop, or place where persons are employed, and may inspect any part of it, and all plant and machinery used in connexion with it, and may make such inquiries as are prescribed or allowed by the regulations.
- (2.) No person shall hinder or obstruct the Statistician or any officer authorized in writing by him in the execution of any power conferred by this section.

Penalty: Ten pounds.

#### PUBLICATION OF STATISTICS.

- 20.—(1.) The Statistician shall compile and tabulate the statistics collected pursuant to this Act and shall publish such statistics or abstracts thereof, as the Minister directs, with observations thereon.
- (2.) All statistics or abstracts prepared for publication and the Statistician's observations thereon (if any) shall be laid before both Houses of the Parliament.

#### PART V.-MISCELLANEOUS.

## PERSON NOT BOUND TO STATE HIS RELIGION.

21. No person shall be liable to any penalty for omitting or refusing to state the religious denomination or sect to which he belongs or adheres.

# DESERTION BY OFFICERS.

22. No officer, after having taken the prescribed declaration, shall desert from his duty, or shall refuse or wilfully neglect, without just excuse, to perform the duties of his office.
Penalty: Twenty pounds.

# UNTRUE RETURNS BY OFFICERS.

23. No officer shall wilfully or without lawful authority alter any document or form under this Act or shall wilfully sign any untrue document or form.

Penalty: Fifty pounds.

# OFFICERS TO OBSERVE SECRECY.

24. No officer shall, except as allowed by this Act or the regulations, divulge the contents of any form filled up in pursuance of this Act, or any information furnished in pursuance of this Act.

Penalty: Fifty pounds.

# FORGERY OF FORMS.

25. Any person who forges, or utters knowing it to be forged, any form or document under this Act, shall be guilty of an indictable offence, and liable to imprisonment for a term not exceeding three years.

# PENALTY FOR FALSE RETURNS OR ANSWERS.

26. No person shall knowingly make in any form or document filled up or supplied in pursuance of this Act or in answer to any question asked him under the authority of this Act any statement which is untrue in any material particular.

Penalty: Fifty pounds.

# REGULATIONS.

27. The Governor-General may make regulations, not inconsistent with this Act, prescribing all matters and things which, by this Act, are required or permitted to be prescribed, or which are necessary or convenient to be prescribed for carrying out or giving effect to this Act.

# APPENDIX 2.

#### CENSUS REGULATIONS.

#### STATUTORY RULES, 1910. No. 96.

#### PROVISIONAL REGULATIONS UNDER THE CENSUS AND STATISTICS ACT 1905.

I, The Governor-General in and over the Commonwealth of Australia, acting with the advice of the Federal Executive Council, do hereby certify that, on account of urgency, the following regulations under the Census and Statistics Act 1905 should come into immediate operation, and make the regulations to come into operation forthwith as Provisional Regulations.

Dated the 27th day of October, One thousand nine hundred and ten.

DUDLEY, Governor-General.

By His Excellency's Command,

KING O'MALLEY,

Minister of State for Home Affairs.

#### CENSUS REGULATIONS.

#### SHORT TITLE.

1. These Regulations may be cited as the Census Regulations 1910.

#### STATE SUPERVISORS.

- 2.—(1.) For each State there shall be an officer called the State Supervisor who shall, subject to the directions of the Commonwealth Statistician, be charged with the duty of taking all necessary steps for the taking and collection of the Census in the State in which he acts.
- (2.) The State Supervisor shall be appointed by the Minister on the recommendation of the Commonwealth Statistician, and shall hold office during the pleasure of the Minister.

# CENSUS DISTRICTS.

- 3.—(1.) The Commonwealth Statistician shall divide each State into as many Census Districts as he thinks necessary.
- (2.) It shall not be necessary to define specifically the boundaries of any Census District, but a general indication of the locality intended to be included in a Census District shall be sufficient.

# ENUMERATORS.

- 4.—(1.) For each Census District there shall be an officer called an Enumerator who shall, in relation to that District, carry out such duties in connexion with the taking and collection of the Census as are imposed on him by the Census and Statistics Act 1905 or these regulations, or as are assigned to him by his instructions or by the State Supervisor.
- (2.) Each Enumerator shall be appointed by the State Supervisor for the State, but his appointment shall be subject to confirmation by the Minister.
- (3.) Each Enumerator shall hold office during the pleasure of the Minister, but not for longer than is necessary to finish the work for which he is appointed.
  - (4.) Each Enumerator shall be paid such remuneration as the Minister approves.

# UNDERTAKING BY ENUMERATOR.

5. Each Enumerator shall, before his appointment or before he commences duty, sign, in the presence of a witness, an undertaking in accordance with the following form:—

# COMMONWEALTH OF AUSTRALIA. The Census and Statistics Act 1905.

# UNDERTAKING BY ENUMERATOR.

I, of , undertake, in connection with the taking of the Census in the year 1911, that I will faithfully perform the duties of Enumerator under the Census Regulations within the Census District in the State of , and will carry out in every particular, all instructions supplied to me by the Commonwealth Statistician or by the State Supervisor for the said State, and that I will not desert from my duty, and will not refuse or neglect, without just excuse, to perform the duties of the office of Enumerator.\*

ust excuse, to perform the duties of the office of En	umerator.*
	Signature
	Date
Vitness	
Address of witness	
• • • • • • • • • • • • • • • • • • • •	• • • • • • • • • • • • • • • • • • • •
*	

<sup>\*</sup> Note.—Under Section 22 of the Census and Statistics Act 1905, an officer who, after having taken the prescribed declaration, deserts from his duty or refuses or wilfully neglects, without just excuse, to perform the duties of his office, is liable to a penalty not exceeding Twenty pounds.

#### COLLECTORS.

- 6.—(1.) For each Census District there shall be so many Collectors as the Commonwealth Statistician thinks necessary.
- (2.) Each Collector shall be appointed by the Enumerator for the Census District, subject to the approval of the Commonwealth Statistician.
- (3.) Each Collector shall hold office during the pleasure of the Commonwealth Statistician, but not longer than is necessary to finish the work for which he is appointed.
  - (4.) Each Collector shall be paid such renumeration as the Minister approves.
- (5.) If in an emergency an Enumerator appoints any person to act as a Collector, such person shall be deemed a Collector if the appointment is ratified by the Commonwealth Statistician.
- (6.) Each Collector shall act under the directions of the Enumerator for the Census District, and shall carry out such duties as are imposed on him by the Census and Statistics Act 1905 and the Regulations thereunder, and shall obey all lawful directions and instructions given him by or through such Enumerator.

#### UNDERTAKING BY COLLECTOR.

7. Each Collector shall, before his appointment, or before he commences duty, sign, in the presence of a witness, an undertaking in accordance with the following form:—

# COMMONWEALTH OF AUSTRALIA.

The Census and Statistics Act 1905

#### UNDERTAKING BY COLLECTOR.

Ι,	of	, undertake, in connection with the takin
of the Census in the year	1911, that I will faithfully r	perform the duties of Collector under the Census Regula
tions within the Censu	s District	in the State of
and will carry out, in e	very particular, all instructio	m the State of one supplied to me by the Commonwealth Statistician
or by the State Superviso	or for the said State, or by the	f e Enumerator for the Census District, and that $f I$ will no
desert from my duty, an	d will not refuse or neglect,	without just excuse, to perform the duties of the office
of Collector.*	_	
		Signature
		Date
Witness		•
Address of witness		
		······································

# HOUSEHOLDER'S SCHEDULE.

- 8.—(1.) The Householder's Schedule shall consist of a Householder's Card, and a Personal Card for each person of the household.
- (2.) The Householder's Card and the Personal Card shall be in accordance with such forms as the Commonwealth Statistician thinks fit.
- (3.) The Householder's Schedule shall, in addition to the particulars specified in section 12 of the Act, include the following:—
  - (a) in relation to buildings—the nature of the building, whether the occupier is the owner, tenant, or rent purchaser, the amount of weekly rent payable or rental value per week;
  - (b) in relation to persons—the race to which they belong, the number of their children living or dead from any existing or previous marriage, the dates of their arrivals in Australia.

# LEAVING OF HOUSEHOLDER'S SCHEDULE.

- 9.—(1.) Each Collector shall, in accordance with his instructions, leave a Householder's Schedule at each dwelling-house within the portion of the Census District for which he acts.
- (2.) The Householder's Schedule shall be left not earlier than seven days (except when in the discretion of the Enumerator for the Census District a longer period is required) and not later than two days before Census Day.
- (3.) The Householder's Schedule should be left with the occupier of the dwelling-house, but, if he or she is not in, with the person apparently in charge of the house. If no person is in, the Householder's Schedule may be placed in a letter box, put under the door, or put in some other place where it is likely to come to the notice of the occupier.

DUTY OF PERSON (OTHER THAN OCCUPIER) RECEIVING HOUSEHOLDER'S SCHEDULE.

10. It shall be the duty of every person (other than the occupier) who receives a Householder's Schedule, or to whose hands or notice a Householder's Schedule has come, to deliver it or bring it to the notice of the occupier for whom it is intended.

Penalty: Five pounds.

<sup>\*</sup> NOTE.—Under Section 22 of the Census and Statistics Act 1905, an officer, who, after having taken the prescribed declaration, deserts from his duty or refuses or wilfully neglects, without just excuse, to perform the duties of his office, is liable to a penalty not exceeding Twenty pounds.

#### DWELLING-HOUSE LET IN SEPARATE PARTS.

11. Where a dwelling-house is let, sub-let, or held in different apartments, and occupied by different persons or families, a Householder's Schedule shall be left for each occupier.

DUTY TO FILL IN REQUIRED PARTICULARS IN THE HOUSEHOLDER'S SCHEDULE.

- 12.—(1.) Under section 12 of the Act, it is the duty of the occupier of every dwelling to fill in the Householder's Schedule, and to sign it, and deliver it to the Collector, and if he fails to carry out this duty he is liable to a penalty of Ten pounds.
- (2.) It shall be the duty of each person who abides in a dwelling-house on the night of Census Day to fill in the particulars required on the Personal Card so far as relates to himself or herself, or to supply to the occupier all information necessary to enable him to fill in such particulars.

Penalty: Ten pounds.

#### HOUSEHOLDERS' SCHEDULES FOR SHIPS.

- 13.—(1.) Householders' Schedules in the case of ships shall be delivered to the Captain of the ship, who shall be deemed the occupier.
- (2.) Where a ship is on a passage between any two Australian ports on Census Day, and no Householder's Schedule was left with the Captain before Census Day, a Householder's Schedule shall be left with the Captain forthwith after the arrival of the ship at a port.
- (3.) The Captain shall, to the best of his knowledge, fill in the particulars required to be filled in in the Householder's Schedule, and return it so filled in to the Collector or other person from whom he received it.

Penalty for breach of paragraph (3): Ten pounds.

(4.) It shall be the duty of each person who abides in a ship on the night of Census Day to fill in the particulars required on the Personal Card so far as relates to himself, or herself, or to supply to the Captain of the ship all information necessary to enable him to fill in such particulars.

Penalty for breach of paragraph (4): Ten pounds.

HOUSEHOLDER'S SCHEDULES FOR PERSONS NOT ABIDING IN DWELLING-HOUSES.

- 14.—(1.) The Householder's Schedule shall be left with each person who does not on the night of Census Day abide in any dwelling-house.
- (2.) Every such person shall thereupon fill in in the Schedule such particulars as are applicable to him, and shall sign the Schedule, and deliver it to the Collector or other person from whom he received it.

Penalty for breach of paragraph (2): Ten pounds.

DUTY OF PERSONS NOT RECEIVING A HOUSEHOLDER'S SCHEDULE TO APPLY FOR IT.

- 15.—(1.) Every person who does not abide in a dwelling-house on the night of Census Day, and who does not receive a Householder's Schedule before that day, shall, within five days after Census Day, apply to the nearest Postmaster for a Householder's Schedule.
- (2.) If the Postmaster has a Householder's Schedule, he shall deliver one to the applicant, and, if he has not, he shall take the name and postal address of the applicant, and forward it to the Enumerator for the District.
- (3.) Every person who receives a Householder's Schedule in pursuance of this regulation shall fill in in the Schedule such particulars as are applicable to him, and shall sign it and return it to the Postmaster or Enumerator, as the case requires.

Penalty: Five Pounds.

# COLLECTOR TO CALL FOR HOUSEHOLDER'S SCHEDULES.

16. A Collector shall, forthwith after Census Day, call at each dwelling-house in the portion of the Census District for which he acts, and ask for and obtain the Householder's Schedule.

# PARTICULARS UNDER SECTION 15 OF THE ACT.

17. The particulars required under section 15 of the Act shall be such of the particulars specified in the Householder's Schedule (other than the particulars relating to the dwelling-house) as are applicable to the person from whom the information is required.

# PENALTIES.

18. The penalty at the foot of any regulation or paragraph indicates that any contravention of the regulation or paragraph is punishable upon conviction by a penalty not exceeding the penalty mentioned.

# APPENDIX 3.

# INSTRUCTIONS FOR FILLING IN THE HOUSEHOLDERS' SCHEDULES, CONSISTING OF THE PERSONAL CARDS "A" AND THE HOUSEHOLDERS' CARDS "B."

Information given on a Census Card is strictly confidential, and is used only for statistical purposes.

#### 1.—GENERAL.

The householder or person in charge of the dwelling is required to fill in the personal cards and the householder's card (forming together a householder's schedule) contained in this envelope (or is to see that each person who abode in the dwelling on the night of Sunday, 2nd April, 1911, himself or herself fills in one of the personal cards). The householder or person in charge of the dwelling is further required to furnish on personal cards particulars regarding those persons travelling or out at work during that night (and not included elsewhere), and who returned to this house or dwelling on Monday, 3rd April. If the house is occupied by different families on separate floors or in separate tenements, each such floor or tenement must be treated as a separate dwelling, and the occupier or person in charge of each must make a return upon a separate householder's card. In the case of large pastoral and other similar establishments the proprietor or superintendent may fill in the returns of his complete establishment, but a separate householder's card must, in this case, be used for each of the out-station dwelling-houses or huts in which a distinct family or person resides in addition to that for the home station; and if any out-station is in a different collector's district from that of the home station, the schedule (householder's and personal cards) for it must be delivered to the Collector of the district in which such dwelling is situated.

Particular attention is drawn to the fact that Section 26 of the Census and Statistics Act 1905 imposes a penalty of Fifty pounds on any person who, in any form supplied under the Act, or in reply to any question asked him under the authority of the Act, shall knowingly make any statement which is untrue in any material particular.

#### 2.—PERSONAL CARDS.

- Line 2.—Write M for Males and F for Females. This is necessary, as the names do not always form a sure indication of the sex.
  - Line 3.—It is important that this information be given with perfect accuracy.
- Line 4.—Write M for married, W for Widower or Widow, D for Divorced, and NM for Never Married, except in the case of children under 12 years of age.
  - Line 5.—Write here the year of existing marriage.
- Line 6.—Write here the number of children born to the existing marriage, whether now living or not; if none, write "None."
- Line 6 (a).—Write here the number of children born to any previous marriage (or marriages), whether now living or not; if none, write "None."
- Line 7.—State whether head, wife, son, daughter, or other relative, visitor, lodger, or servant; and, in the case of public institutions, whether officer, inmate, prisoner, &c.
- Line 8.—Information is required only as to blindness and deafmutism. Enter as blind only persons totally unable to see, and as deaf and dumb only those who are dumb as well as deaf.
- Line 9.—If born in Commonwealth, enter the name of the State of birth; if born elsewhere, enter the name of the country of birth.
- Line 10.—If a British subject by parentage, whether born in the United Kingdom, in a British possession, in a foreign country, or at sea, write P; if a British subject by naturalization, write N. If not of European race, write Aboriginal, Chinese, Japanese, Hindu, Javanese, Manilaman, Negro, Polynesian, or Aboriginal half-caste, Chinese half-caste, &c., &c., as the case may be.
- Line 11.—If not born in Commonwealth, state length of residence therein in years, and also state date of arrival in Commonwealth.
  - Line 12.—Do not use general terms that include more than one religious denomination or sect.
  - In the case of children enter the name of the religion in which it is intended they shall be brought up.
  - If you object to state to what religious denomination you belong, write "Object."
- Line 13.—Write CR for cannot read, R for read only, and RW for read and write. If not able to read English, but able to read a foreign language, write RF, and if not able to read and write English, but able to both read and write a foreign language, write RWF.
- If the person to whom the card relates has obtained a University degree, state the degree, and give the name of the University and country in which it was obtained.
- Line 13 (a).—Write U if at University; S if at State School; P if at any other school; and H if being educated at home. Give name of school.

# Line 14.---

- Army and Navy.—If on actual service, state so. If retired, state present occupation.
- Persons in the Service of the Federal, State, or Local Governments are to state occupation, position, department, adding F if in Federal, S if in State, and L if in Local Government service; and if engaged in any other occupation, to specify its nature.
- Justices of the Peace, Aldermen, Town Councillors, &c., and other important public officers are to state their ordinary profession or occupation.
- Ministers of Religion are to state denomination. The indefinite term "Clerk" must not be used. Local or occasional preachers are to return their ordinary occupation.

Members of the Legal Profession are to state whether in actual practice; if not practising, to state present occupation. Persons employed in solicitors' offices are to state whether they are articled or other clerks.

Members of the Medical Profession are to state whether they are physicians, surgeons, or general practitioners, and to return themselves as practising, or not practising; if not practising, to state present occupation.

Teachers, Authors, Public Writers, and Artists are to state the particular branch of science, literature, or art in which they are engaged.

Engineers are to state whether civil, mechanical, electrical, mining, marine, &c.; also the nature of work on which engaged.

Surveyors are to state whether land, mining, marine, &c.

Engine-drivers, Stokers, Firemen, &c., are to state the nature of the business in connexion with which they are occupied, thus:—"Engine-driver at Sawmill," "Stoker at Foundry," "Fireman on Railway," &c. Engine-drivers are not to be entered as engineers.

Miners are to specify the nature of the mineral on which they work, and in respect of metallic ores, to state whether lode or alluvial. A miner working for another is to return himself as "miner," and not as "labourer."

Artisans and Mechanics are to state the particular branch of their trade, thus—"Ship's carpenter," "House carpenter," "Coachsmith," "Locksmith," "Horseshoer," &c.

Carters, Carriers, Labourers, Servants, &c., are to be described in connexion with their usual employment thus:—"Carter to grocer," "Bullock-driver on station," "Labourer making roads," "Omnibus-driver," "Cabman," "Railway porter," "Telegraph messenger," "Domestic servant."

Persons engaged in Trade or Commerce, as Merchants, Manufacturers, Storekeepers, Retailers, Brokers, Agents, Auctioneers, &c., are to state the particular business in which they are engaged, or the principal commodity in which they deal, thus:—"Grain merchant," "Hat manufacturer."

Clerks, Bookkeepers, Salesmen, Saleswomen, Shopmen, Commercial Travellers, &c., are to be described according to the business with which they are connected, thus:—"Bank clerk,""Railway clerk," "Salesman in softgoods warehouse," "Shopman to grocer," "Commercial traveller to wine merchant," &c.

Farmer or Market Gardener.—These terms are to be applied to all persons actually in occupation of land and tilling, whether proprietors or tenants; the term "landowner" is too vague. Market gardeners must not omit the word "Market." The term "Farmer" is understood to mean "Agricultural farmer"; if "Dairy" or "Poultry farmer," &c., it should be so stated.

Persons not following any Profession, Trade, or Calling, and not holding any public office, but possessed of independent means, are to designate themselves as "Proprietor of land," "Proprietor of houses," "Capitalist," "Annuitant," as the case may be. The term "Householder" is not to be used in place of "Proprietor of houses," nor the words "Gentleman" or "Lady" in place of "No occupation."

Wives, Sons, Daughters, Brothers, and other Relatives habitually helping on farms and stations, or engaged in hotels, shops, or other industrial pursuits, are to be returned as "Wife assisting," "Son assisting," &c., as the case may be.

Women.—The occupations of women who are engaged in any other than domestic duties are to be distinctly recorded, but women are not to be entered as engaged in the occupations of their husbands, fathers, &c., unless they habitually assist them. When only in the capacity of wife, mother, daughter, sister, &c., write "Domestic duties."

Children being educated are to be designated "Scholar," if not engaged as well in any industrial pursuit; but if following any such pursuit during portion of their time, as, for instance, delivering or selling newspapers, minding cows, &c., before or after school hours, are to be set down as following that pursuit, the entry on line 13 (a) sufficiently showing that they are also receiving education.

Persons in Hospitals, Asylums, Gaols, &c.—The position of officers in the Institution, as "Warder," "Nurse," &c., is to be given, and in the case of immates, "Prisoner," "Patient," &c.; their calling (if any) before they entered the institution is to be inserted on line 14.

N.B.—Great care is to be taken in writing the name of an occupation which is common to many kinds or branches of business, to add the name of the employer's trade or business. The following occupations are of this type, and require the additional information suggested within parentheses, thus:—Assistant (to draper), Accountant (to ironmonger), Apprentice (to baker), Agent (for shipping company), Cashier (in bank), Clerk (to brewer), Carter (to miller), Engine-driver (on railway), Labourer (on wharf, on roads, &c.), &c., &c. Persons engaged in more than one occupation are requested to state their several occupations, and to underline the principal one.

Line 14 (a) and (b).—Write E if an employer of labour other than household servants; O if in business on own account but not employing others for salary or wages; A if assisting head of household in his business but not receiving salary or wages; W if earning salary or wages; and (except in cases of leave of absence) add N if out of work for more than a week prior to Census, stating under (b) period during which out of work.

Line 14 (c).—If earning salary or wages, state occupation of employer.

# 3.—HOUSEHOLDERS' CARDS.

**BUILDINGS.—Line 1.**—State whether a private house; a tenement in a private house; a hotel, boarding, or lodging house; a religious or educational institution; a military establishment; a charitable institution; or a penal establishment.

Line 2.—State whether the outer walls are built of stone, brick, concrete, wood, iron, canvas, or any other material.

Line 3.—State number of rooms, including kitchen, but excluding shop, office, store, bathroom, pantry, or outhouses, unless some one sleeps therein. In the case of a tenement, give number of rooms in tenement only. In case of a building the only resident whereof is a caretaker, give number of rooms in caretaker's quarters only.

Line 4.—Write O if owner; T if tenant; or R P if rent purchaser.

# APPENDIX 4.

# ARRANGEMENTS CONCERNING EMPLOYMENT OF STATE OFFICERS UNDER THE CENSUS AND STATISTICS ACT 1905.

#### I.-NEW SOUTH WALES.

DEPARTMENT OF HOME AFFAIRS,

MELBOURNE, 31st October, 1910.

Arrangement between the Governor-General of the Commonwealth of Australia and the Governor of the State of New South Wales; making provision for the execution by certain State officers of powers and duties under the Census and Statistics Act 1905.

Pursuant to the Census and Statistics Act 1905, and to all other enabling powers, His Excellency the Governor-General-in-Council has approved of an arrangement in the following terms, being made between His Excellency the Governor-General-in-Council and His Excellency the Governor-in-Council of the State of New South Wales, for the facilitating of the taking of the Census in the year 1911, that is to say:—

- (1) That JOHN BURT TRIVETT, Esq., F.S.S., F.R.A.S., an officer of the State of New South Wales, may be appointed to and may execute the powers and duties of the Supervisor of Census for that State under the *Census and Statistics Act* 1905, and the regulations thereunder.
- (2) That the services of State officers of the State of New South Wales shall, so far as the exigencies of the State service will allow, be available in connexion with the taking of the Census, and any such officers may, with the concurrence of the Head of the State Department in which they are employed, be appointed to any office or position in connexion with the taking of the Census, and may execute the powers and duties of such office or position accordingly.
- (3) That any State officer appointed in pursuance of such arrangement to any office or position in connexion with the taking of the Census shall be subject to the direction of the Commonwealth authorities in relation to the carrying out of the powers and duties attaching to his office or position.
- (4) That such arrangement shall be deemed to have taken effect on and from the 1st day of July, 1910.

KING O'MALLEY,

Minister of State for Home Affairs.

G.10/4389.

## II.-VICTORIA.

DEPARTMENT OF HOME AFFAIRS,

MELBOURNE, 31st October, 1910.

Arrangement between the Governor-General of the Commonwealth of Australia and the Governor of the State of Victoria, making provision for the execution by certain State officers of powers and duties under the Gensus and Statistics Act 1905.

Pursuant to the Census and Statistics Act 1905, and to all other enabling powers, His Excellency the Governor-General-in-Council has approved of an arrangement in the following terms, being made between His Excellency the Governor-General-in-Council and His Excellency the Governor-in-Council of the State of Victoria, for the facilitating of the taking of the Census in the year 1911, that is to say:—

- (1) That ALEXANDER MILLAR LAUGHTON, Esq., F.I.A., F.F.A., an officer of the State of Victoria, may be appointed to and may execute the powers and duties of the Supervisor of Census for that State under the Census and Statistics Act 1905, and the regulations thereunder.
- (2) That the services of State officers of the State of Victoria shall, so far as the exigencies of the State service will allow, be available in connexion with the taking of the Census, and any such officers may, with the concurrence of the Head of the State Department in which they are employed, be appointed to any office or position in connexion with the taking of the Census, and may execute the powers and duties of such office or position accordingly.
- (3) That any State officer appointed in pursuance of such arrangement to any office or position in connexion with the taking of the Census shall be subject to the direction of the Commonwealth authorities in relation to the carrying out of the powers and duties attaching to his office or position.
- (4) That such arrangement shall be deemed to have taken effect on and from the 1st day of July, 1910.

KING O'MALLEY,

Minister of State for Home Affairs.

G.10/4387.

#### III,-QUEENSLAND.

#### DEPARTMENT OF HOME AFFAIRS.

MELBOURNE, 31ST OCTOBER, 1910.

Arrangement between the Governor General of the Commonwealth of Australia and the Governor of the State of Queensland, making provision for the execution by certain State officers of powers and duties under the Census and Statistics Act 1905.

Pursuant to the Census and Statistics Act 1905, and to all other enabling powers, His Excellency the Governor-General-in-Council has approved of an arrangement in the following terms, being made between His Excellency the Governor-General-in-Council and His Excellency the Governor-in-Council of the State of Queensland, for the facilitating of the taking of the Census in the year 1911, that is to say:—

- (1) That THORNHILL WEEDON, Esq., F.S.S., an officer of the State of Queensland, may be appointed to and may execute the powers and duties of the Supervisor of Census for that State under the Census and Statistics Act 1905, and the regulations thereunder.
- (2) That the services of State officers of the State of Queensland shall, so far as the exigencies of the State service will allow, be available in connexion with the taking of the Census, and any such officers may, with the concurrence of the Head of the State Department in which they are employed, be appointed to any office or position in connexion with the taking of the Census, and may execute the powers and duties of such office or position accordingly.
- (3) That any State officer appointed under such arrangement shall, so far as it does not conflict with his duties as a State officer, be subject to the direction of the Commonwealth authorities as regards the taking of the Census.
- (4) That such arrangement shall be deemed to have taken effect on and from the 1st day of July, 1910-

KING O'MALLEY.

Minister of State for Home Affairs.

G.10/4385.

#### IV .-- SOUTH AUSTRALIA.

DEPARTMENT OF HOME AFFAIRS,

MELBOURNE, 31ST OCTOBER, 1910.

Arrangement between the Governor-General of the Commonwealth of Australia and the Governor of the State of South Australia, making provision for the execution by certain State officers of powers and duties under the Census and Statistics Act 1905.

Pursuant to the Census and Statistics Act 1905, and to all other enabling powers, His Excellency the Governor-General-in-Council has approved of an arrangement in the following terms, being made between His Excellency the Governor-General-in-Council and His Excellency the Governor-in-Council of the State of South Australia, for the facilitating of the taking of the Census in the year 1911, that is to say:—

- (1) That LIONEL HENRY SHOLL, Esq., I.S.O., J.P., an officer of the State of South Australia, may be appointed to and may execute the powers and duties of the Supervisor of Census for that State under the Census and Statistics Act 1905, and the regulations thereunder.
- (2) That the services of State officers of the State of South Australia shall, so far as the exigencies of the State service will allow, be available in connexion with the taking of the Census, and any such officers may, with the concurrence of the Head of the State Department in which they are employed, be appointed to any office or position in connexion with the taking of the Census, and may execute the powers and duties of such office or position accordingly.
- (3) That any State officer appointed in pursuance of such arrangement to any office or position in connexion with the taking of the Census shall be subject to the direction of the Commonwealth authorities in relation to the carrying out of the powers and duties attaching to his office or position.
- (4) That such arrangement shall be deemed to have taken effect on and from the 1st day of July, 1910.

KING O'MALLEY,

Minister of State for Home Affairs.

G.10/4388.

# V.—WESTERN AUSTRALIA.

DEPARTMENT OF HOME AFFAIRS,
MELBOURNE, 24TH NOVEMBER, 1910.

Arrangement between the Governor-General of the Commonwealth of Australia and the Governor of the State of Western Australia, making provision for the execution by certain State officers of powers and duties under the Census and Statistics Act 1905.

Pursuant to the Census and Statistics Act 1905, and to all other enabling powers, His Excellency the Governor-General-in-Council has approved of an arrangement in the following terms, being made between His Excellency the Governor-General-in-Council and His Excellency the Governor-in-Council of the State of Western Australia, for the facilitating of the taking of the Census in the year 1911, that is to say:—

(1) That MR. E. G. STENBERG, an officer of the State of Western Australia, may be appointed to and may execute the powers and duties of the Supervisor of Census for that State under the Census and Statistics Act 1905, and the regulations thereunder.

- (2) That the services of State officers of the State of Western Australia shall, so far as the exigencies of the State service will allow, be available in connexion with the taking of the Census, and any such officers may, with the concurrence of the Head of the State Department in which they are employed, be appointed to any office or position in connexion with the taking of the Census, and may execute the powers and duties of such office or position accordingly.
- (3) That police inspectors and other senior police officers may act as enumerators where convenient.
- (4) That other State officials may act as enumerators where convenient.
- (5) That the services of police constables may be made available where practicable for positions of collectors.
- (6) That in all cases an agreement is to be arrived at beforehand as to rate to be charged for such services.
- (7) That in all cases the officer concerned is to receive special remuneration in respect of Census work.
- (8) That the Census printing is to be done when convenient by the Government Printer at cost price.
- (9) That all plans available for distribution are to be supplied by Survey Department at cost price.
- (10) That all drafting work required to be done is, when convenient, to be done by the Survey Department at cost price.
- (11) That the Census collection is to be carried out entirely at the Commonwealth expense. The State Government to be free of all expense or responsibility.
- (12) That the State is to have the first claim on the services of its officers undertaking Census work.
- (13) That this arrangement shall be deemed to have taken effect on and from the 1st day of July, 1910.

KING O'MALLEY,

0/4794

Minister of State for Home Affairs.

G.10/4784.

#### VI.—TASMANIA.

DEPARTMENT OF HOME AFFAIRS,

MELBOURNE, 31st October, 1910.

Arrangement between the Governor-General of the Commonwealth of Australia and the Governor of the State of Tasmania, making provision for the execution by certain State officers of powers and duties under the Census and Statistics Act 1905.

Pursuant to the Census and Statistics Act 1905, and to all other enabling powers, His Excellency the Governor-General-in-Council has approved of an arrangement in the following terms, being made between His Excellency the Governor-General-in-Council and His Excellency the Governor-in-Council of the State of Tasmania, for the facilitating of the taking of the Census in the year 1911, that is to say:—

- (1) That ROBERT MACKENZIE JOHNSTON, Esq., I.S.O., F.S.S., an officer of the State of Tasmania, may be appointed to and may execute the powers and duties of the Supervisor of Census for that State under the Census and Statistics Act 1905, and the regulations thereunder.
- (2) That the services of State officers of the State of Tasmania shall, so far as the exigencies of the State service will allow, be available in connexion with the taking of the Census, and any such officers may, with the concurrence of the Head of the State Department in which they are employed, be appointed to any office or position in connexion with the taking of the Census, and may execute the powers and duties of such office or position accordingly.
- (3) That any State officer appointed in pursuance of such arrangement to any office or position in connexion with the taking of the Census shall be subject to the direction of the Commonwealth authorities in relation to the carrying out of the powers and duties attaching to his office or position.
- (4) That such arrangement shall be deemed to have taken effect on and from the 1st day of July, 1910.

KING O'MALLEY,

Minister of State for Home Affairs.

G.10/4386.

# APPENDIX 5.

#### INSTRUCTIONS TO STATE SUPERVISORS OF CENSUS.

- 1. Appointment.—A copy of the Commonwealth Gazette containing a notice of your appointment as State Supervisor of Census is forwarded herewith.
- 2. Census Act.—A copy of the Census and Statistics Act 1905, is also forwarded for your information. The provisions of this Act relating to Census collection should be carefully perused by you, and any queries, comments, or suggestions in connexion therewith which you may desire to make should be forwarded without delay to the Commonwealth Statistician.
- 3. Division of State.—As early as practicable, maps will be forwarded to you, setting out the partition of your State into Census Districts.
- 4. Emolument of Enumerators.—As soon as practicable after the receipt of these maps, it will be your duty to forward to the Commonwealth Statistician for his approval a statement, on Census Form No. 10, shewing what, in your opinion, would be a fair rate of emolument for the person undertaking the duties of enumerator in each Census District. For your general guidance, it may be stated that a retaining fee of £10 10s., together with a further payment based on the work involved, should be provided. In estimating this further payment, the area and probable population of the Census District should be taken into account.
- 5. Selection of Enumerators.—On receipt of the Commonwealth Statistician's approval of your scale of emolument for enumerators, it will be your duty to select for each Census District a duly qualified person willing to undertake the duties of enumerator at the rate of emolument specified.
- 6. Qualifications of Enumerators.—The person selected to act as enumerator for any Census District should possess the following qualifications:—
  - (a) Accurate knowledge of his Census District;
  - (b) Administrative capacity;
  - (c) Integrity;
  - (d) Fair education.
- 7. Suitable Persons for Employment.—Where obtainable, the following persons will usually be found suitable for appointment:—
  - (a) Resident Magistrates or Police Magistrates;
  - (b) Town Clerks;
  - (c) Shire Secretaries;
  - (d) Clerks of Courts;
  - (e) Mining Registrars;
  - (f) Electoral Returning Officers;
  - (g) Persons who have satisfactorily performed similar duties on a previous occasion.
- 8. Inquiry for Enumerators.—Where suitable persons, such as those referred to in paragraph 7, are not available, it will be your duty to take such steps as the circumstances may require to secure a person in each case having the requisite qualifications. For this purpose, inquiry from a Stipendiary, Resident, or Police Magistrate, or an Inspector of Police, may effect the desired result. Failing that, it may be necessary as a last resource to advertise in a newspaper circulating in the district.
- 9. Submission for approval by Commonwealth Statistician.—On the completion of your list of enumerators, which should be expedited as much as possible, the list must be forwarded to the Commonwealth Statistician for approval, on Census Form No. 10, which should be accompanied by any comments or suggestions which you may desire to make in connexion therewith.
- 10. Appointment of Enumerators.—On receipt of approval of the list of enumerators submitted by you, it will be your duty to formally notify the persons approved of their appointment, at the same time obtaining from each a declaration of secrecy and fidelity, and a contract of service, special forms for which will be forwarded to you. A duplicate of the contract of service shall be retained by the enumerator.
- 11. Gazetting of Enumerators.—On receipt by you of all the declarations of fidelity and secrecy, and contracts of service, it will be your duty to forward a notification to that effect to the Commonwealth Statistican, in order that the appointment of enumerators may be duly published in the Commonwealth Gazette.
- 12. Retention of Declarations.—All declarations and contracts of service made by enumerators are to be carefully retained by you until the completion of your duties as Supervisor of Census, and are then to be forwarded to the Commonwealth Statistician.
- 13. Emergency Appointment of Enumerators.—In case of accident, sickness, death, or other cause preventing an enumerator from carrying out the duties of his office, it will be necessary for you, with as little delay as possible, to appoint a suitable substitute to act in a temporary capacity pending the formal approval of his appointment.
- 14. Enumerators' Maps.—On receipt from you of the notification of appointment of enumerators, the Commonwealth Statistician will forward to each enumerator a list of instructions, and also a map of his Division on a large scale, for subdivision into Collectors' Districts. These Districts will require to be of such size that the work of distributing and collecting Census Forms therein can be readily carried out in the prescribed time,

- 15. Approval of Enumerators' Subdivision.—On the completion of this work of subdivision, it will be the duty of each enumerator to forward his map to you, accompanied by a rough description of the boundaries proposed by him, and a name for each proposed district. In certain cases these maps and descriptions may require to be returned to the enumerators for explanation or amendment. After satisfying yourself that the districts proposed are suitable, and are in accordance with the instructions in connection therewith issued to the enumerator, it will be your duty to forward the maps and descriptions to the Commonwealth Statistician.
- 16. Maps.—On approving the subdivisional scheme submitted, the Commonwealth Statistician will cause to be prepared sets of maps shewing Collectors' Districts. A list of these will be forwarded to you for your information and guidance, and a map of his Census District, shewing the boundaries of the Collectors' Districts which it comprises, will be forwarded to each enumerator, and a set of maps, each dealing with one collector's District, will be forwarded for the use of the collectors themselves. A general map will also be forwarded for your guidance.
- 17. Selection of Collectors.—As early as possible after the approval of his scheme of subdivision, it will be the duty of each enumerator to nominate for each of the Collectors' Districts comprised in his Division, a person whom he considers suitable to act as collector.
- 18. Qualifications of Collectors.—Any person selected to act as collector should possess the following qualifications:—
  - (a) Accurate knowledge of his district;
  - (b) Fair elementary education;
  - (c) Ability to write neatly and legibly;
  - (d) Integrity;
  - (e) Sobriety;
  - (f) Absence of physical incapacity.
- 19. Approval of Appointment of Collectors nominated.—On completing his list of collectors, it will be the duty of each enumerator to submit the list for your revision.
- 20. Appointment of Collectors.—After revising the list of collectors, it will be your duty to transmit same to the Commonwealth Statistician.

On receipt of a letter from the Commonwealth Statistician that the revision is considered satisfactory you should transmit to the enumerator the necessary forms of agreement between the enumerator and the collector, together with the letter of authority to act as collector.

This letter must not be delivered to the collector by the enumerator until the collector has made a declaration of fidelity and secrecy, and has executed the agreement for service on forms which will be duly forwarded to the enumerators for that purpose.

- 21. Retention of Declarations.—It will be the duty of the enumerators to forward to you all declarations and, on the satisfactory completion of service, also the agreements for service made by the collectors. These are to be carefully retained by you until the completion of your duties, when they must be forwarded to the Commonwealth Statistician.
- 22. Instructions to Enumerators and Collectors.—It will be your duty to make yourself familiar with the instructions issued to enumerators and collectors, so as to be in a position to promptly advise these officers on any points which may arise in the performance of their respective duties. In the event of doubt on your part as to the exact significance of any instructions, or as to the course of action to be taken in any matter not provided for in the instructions, you should communicate immediately with the Commonwealth Statistician, if time will permit. In certain cases, however, such matters will have to be decided at once, and it will be necessary for you to act on your own responsibility, basing your decision, as far as practicable, on the tenor of the instructions relating to allied matters.
- 23. Emergency Appointment of Collectors.—In certain cases, owing to accident, sickness, death, or other causes, a duly appointed collector may be prevented from carrying out his duties.

If time will admit, any such vacancy should be filled in the ordinary way, a letter of appointment being delivered to the collector by the enumerator after the requisite declaration of fidelity and secrecy and agreement for service have been made. If time will not admit of this procedure, the enumerator will be authorised to fill the vacancy on his own responsibility.

- 24. Census Posters.—During the month of January, 1911, a supply of posters, relative to the forth-coming Census will be forwarded to you. These will require to be transmitted to each Post Office, Police Station, Police Court, Railway Station, State School, Mechanics', Miners', or Agricultural Institute, or School of Arts, or other suitable place in your State, with a request to the Officer-in-charge that they be affixed in a conspicuous place, and allowed to remain there until after the taking of the Census. These posters will set forth the date of the Census, the nature of the information required, and the penalties attaching to a failure to comply with the requirements of the Act.
- 25. Final Revision of Census Arrangements.—During the month of March, 1911, it will be necessary for you to assure yourself that all preparations for the Census have been duly made, and that all enumerators and collectors are ready to carry out the work of collection expeditiously. Care must be taken that no islands lying off the coast, or in bays, rivers, or elsewhere, have been omitted from the scheme of collection.
- 26. Preliminary Count.—It will be the duty of each enumerator, as soon as he receives a preliminary count from a collector, to forward it to you. As soon as the whole of the preliminary counts for any Census District is complete, it will be your duty to forward the results to the Commonwealth Statistician. It is hoped that the preliminary count for the whole of the Commonwealth will, by these means, reach the Commonwealth Statistician not later than the 30th April, 1911. Unless specially instructed to the contrary, the results of these preliminary counts should be forwarded by letter, not by telegraph.
- 27. Transmission of Forms.—On satisfying himself that the whole of his Census District has been duly accounted for, it will be the duty of each enumerator to forward to you the boxes or parcels containing the schedules, &c., representing his Census District. On satisfying yourself that all of the Collector's Districts within the Census District have been accounted for, and that the work has the appearance of having been carefully done (detailed examination of the individual forms is not required), the forms should be securely repacked in the boxes or parcels, with a label attached, indicating the State and Census District to which they relate and the number of forms included, and forwarded to the Commonwealth Statistician.

- 28. Enumerator's Vouchers.—Each of the enumerators in forwarding the Census Forms relating to his Census District, will submit a voucher for the amount for which he has himself contracted to act as enumerator, and setting out in detail the amounts due to each individual collector in his District. On approving the manner in which the work has been performed, it will be your duty to transmit the voucher to the Commonwealth Statistician, with a certification that the duties of the enumerator and of the collectors have been satisfactorily performed.
  - 29. Postal and Telegraphic Arrangements:
    - (a) State Supervisors will be allowed a stamp advance of £10, and will stamp outgoing letters, and pay for telegrams and incoming letters by stamps.
    - (b) Enumerators will be allowed a preliminary stamp advance of £3, and will stamp outgoing letters, and pay for telegrams and incoming letters by stamps.
    - (c) Collectors will send all letters and telegrams to enumerators and State Supervisors unstamped, and marked "collect," and the enumerator or State Supervisor, as the case may be, will pay for them by stamps on receipt.
    - (d) In the few cases where a collector will have to send a letter on Census business to a private person, he will have to stamp the letter, make a note of the circumstances, and recover the amount from his enumerator.
    - (e) Any amounts thus refunded will be included by the enumerator in the voucher to be forwarded by him on completion of his work to the State Supervisor.
    - (f) All communications or parcels on Census business passing through the Post or Telegraph Offices must be marked "Census."
    - (g) With a view to minimising the cost of the Census, you are requested to send as "Printed Papers" or "Commercial Papers," as the case may be, such wholly or partly printed documents as may under the Postal Act be sent under those designations.
- 30. Printing.—It is intended to have the personal cards A, householders' cards B, instruction C, and envelopes D, required for the taking of the Census in your State printed by your Government Printer. It will, therefore, be your duty to exercise such supervision over the printing thereof as may be necessary, and to arrange for the packing and transmission to the enumerators of the requisite numbers of eards and other documents.
- 31. Period of Appointment.—Your appointment as State Supervisor of Census will date from 1st July, 1910, and will terminate on 30th June, 1911, unless arrangements are made for retaining your services for a longer period.
- 32. General Census Provisions.—All matters connected with the advertisement of the Census through the press, the contribution of articles to the press relating to Census matters, the giving of lessons on Census matters in State and other schools, will be dealt with by the Commonwealth Bureau of Census and Statistics, but any suggestions which you may wish to make in reference to any of these matters will be much appreciated and carefully considered.

(Signed) G. H. KNIBBS,

Commonwealth Statistician.

Commonwealth Bureau of Census and Statistics, Melbourne, 30th June, 1910.

# APPENDIX 6.

# INSTRUCTIONS TO RECORD CLERKS ASSISTING STATE SUPERVISORS OF CENSUS.

- 1. Records the Property of Commonwealth Bureau.—The Census Records of the State Supervisor's office are the property of the Commonwealth Bureau of Census and Statistics, and when the work of Census collection has been completed, they must be forwarded to the Bureau.
- 2. Necessity for Uniformity.—It is necessary, therefore, that the system adopted for conducting the correspondence and keeping the records in the several States should be carried out on uniform lines. With this end in view, the following instructions have been drafted.
- 3. Date of Receipt of "Correspondence Inwards."—All "Correspondence Inwards" must, as soon as practicable after it is received, be stamped with the date of receipt by means of the dating machine provided for the purpose. This is of considerable importance as an item of record, and must never be omitted.
- 4. Appropriate Files to be Prepared.—For the purposes of classification and ready reference, a series of files must be prepared, in which all correspondence inwards, and copies of all correspondence outwards must be placed. Each file must relate to a separate subject, which must be distinctly shewn on the file cover. Files must be numbered from 1 upwards in the order in which the occasion for their preparation arises.
- 5. Order and Numbering of Papers in File.—Each file must, as regards date of papers contained, be built upwards, the most recent communication appearing on top. All papers contained in file must receive the file number, and must, in addition, be numbered from 1 upwards, following the order in which the file is built up. Where any single communication on a file extends to more than one sheet, the consecutive numbering must be continued on the several sheets comprised in the communication, and must not be restricted to the first sheet only. Each sheet will thus bear two numbers, the former of which will relate to the file, and the latter to the consecutive number of the sheet on its file. The marking 3/6 for example, would indicate that the document in question was the sixth page of File No. 3. These numbers must be recorded in red ink in the right hand upper corner of the paper.
- 6. Size and Attachment of Papers.—All papers placed on a file must be of foolscap size. If communications are received of a smaller size than foolscap, they must be pasted on foolscap sheets before inclusion on the file. Documents of a larger size than foolscap must be folded to that size, and, if practicable, must be so attached to the file that they can be opened out and their contents seen without being detached from the file. Wherever practicable, the papers comprised in any file are to be fastened together by means of a paper fastener, on the upper left-hand corner.
- 7. File Covers.—A supply of file covers (see Form A herewith) for the use of the record clerk will be furnished, and early application for additional supply, as required, must be made from time to time.
- 8. Precis Sheets to be kept.—In connexion with each file, a Precis Sheet, in Form B hereto, must be kept, on which all papers belonging to the file must be duly recorded. In the column provided for "Nature of communication," a very brief statement of the object or purport of communication must be given. When a Précis Sheet relating to any file has been filled, a fresh one must be added above the completed one, and the appropriate Précis Sheet No. must be inserted in the upper right-hand corner of the new sheet. The fact must also be noted at the foot of the completed sheet as follows:—"Continued on Précis Sheet No......" Where a communication extends to more than one page, the fact must be noted on the Précis Sheet by including in the column for "No. of Paper," a reference to all the pages comprised in the communication. Thus 7—12 would indicate a communication extending from pages 7 to 12 inclusive of the file in question. As the Précis Sheet is intended to furnish a complete record of the contents of the file, it must be kept strictly up to date.
- 9. Correspondence Inwards to be recorded promptly.—As soon as practicable after any communication has been received, it must be marked with its appropriate file and consecutive numbers, and must be promptly recorded on the Précis Sheet of the file to which it belongs. Unless the circumstances are very exceptional, the communication should in all cases be recorded on the appropriate Prècis Sheet, before being dealt with by the Census Supervisor.
- 10. Correspondence Outwards on Precis Sheets to be specially marked.—In entering on Precis Sheets particulars concerning correspondence outwards contained in the file, it will be desirable to make the necessary entries in red ink so as to distinguish them readily from entries relating to Correspondence Inwards.
- 12. File Indexes.—All papers contained in a file must be briefly indexed in the Index Book provided for the purpose. In all cases the indexing must be done according to the name or designation of the person by, to, or concerning whom the communication was sent, and also according to the subject of correspondence. Where a communication deals with several phases of a subject, it must be indexed under such subject headings as will enable these phases to be readily traced. Where it is anticipated that the correspondence with any person or on any subject will be extensive, sufficient space should be reserved in the Index Book to meet probable requirements under that heading.

The File No., as well as the consecutive No. of the paper, must always be quoted against an index entry.

13. Cross References.—When a paper on one file contains reference to the subject of another file, a copy of such reference should be attached to the latter file, or a reference thereto should be made on its Précis Sheet duly indexed.

- 14. Detached Papers.—Only under very exceptional circumstances should papers once placed on a file be detached therefrom. If such detachment takes place, a slip of paper must invariably be inserted in the place from which the paper has been removed, stating the number of the paper, and by whom, and why, it was detached.
- 15. List of Files.—A list of files, arranged in numerical order, should be kept in a conspicuous place for convenience of reference. When a new file has been made, its number and subject must be promptly entered on this list, which will thus be kept always up to date.
- 16. Precis Sheets to be kept clean and neat.—As it is proposed to bind the Precis Sheets into book form on the completion of the Census collection, it is necessary that they should be prepared as neatly and kept as clean as possible. The left hand margin of the Precis Sheet is to be left blank, so as to facilitate binding.
- 17. Correspondence Outwards.—Each letter should, as far as practicable, be restricted to one subject, and should be on one side of the paper only. All letters must be typed in triplicate, one copy (on stout paper) to be attached to the file to which it refers (numbered consecutively), and the other copy (on flimsy paper) to be pasted in the Letter Book provided for the purpose.
- 18. Letter Book Index.—The Letter Book must be kept indexed up to date. An index, shewing the names of the persons to whom communications are addressed, together with a brief précis of the subject-matter, will be sufficient for this purpose.
- 19. Letter Number.—It is always desirable to quote on a letter outwards the file and consecutive number of the document (if any) to which it is in reply, as such a course facilitates subsequent reference.
- 20. Postage Book.—All correspondence outwards, whether by telegraph, by post, or by messenger must be carefully recorded in the Postage Book provided for the purpose. In this book must be inserted the name and address of the addressee, the means of communication, and the postal or telegraphic charge (if any) involved.
- 21 Stamps.—All letters, telegrams, and other matters on which postal charges are payable must have the requisite amount affixed in "O.S." stamps. To enable this to be done, a stamp advance of £10 will be made to the Census Supervisor.

It will be the duty of the Record Clerk, acting under the instructions of the Census Supervisor, to keep an account of the stamps received from time to time for Census purposes, and to balance such account with the Postage Book. It will also be his duty when the supply of stamps runs low, to call the attention of the Supervisor to the fact, so that a further advance may be obtained. It will also be his duty to keep a record of any postage or telegraph debit dockets, with the amounts involved, issued by the Supervisor in lieu of stamps.

22. Stationery.—A supply of file covers, precis sheets, letter heads, and envelopes, together with a letter book, an index book, and a postage book, will be forwarded for use in connection with the work of Census collection. In the event of further supplies being required, early application must be made.

(Signed) G. H. KNIBBS,

Commonwealth Bureau of Census and Statistics, Melbourne, 30th June, 1910.

Commonwealth Statistician.

# FORM A. (See Clause 7).

File No.	STATE.	Subject.	Prècis Sheet No.		

# FORM B. (See Clause 8).

No. of Paper.	Date of Communication.	From or to Whom.	Nature of Communication.

# APPENDIX 7.

#### FINANCIAL INSTRUCTIONS.

#### A .- STATE SUPERVISORS.

#### 1.—SUB-ADVANCE.

A sub-advance will be made to each State Supervisor, to be operated on by him for the purpose of paying accounts for incidental and petty cash expenditure. Any single disburgement from this sub-advance must not exceed \$1.

An acquittance must be obtained for the payment of any sum over 5s.

The sub-advance will be recouped periodically as the necessity arises in the following manner, viz.:— Each State Supervisor will prepare an account, on Form 9, in his favour and official capacity for the disbursements made, attach thereto the acquittances obtained, sign account as claimant, and forward to the Accountant, Department of Home Affairs, Melbourne.

Accounts for amounts over £1 must be rendered on Commonwealth Contingencies Form No. 9.

#### 2.—BANKING ACCOUNT.

For the purpose of the sub-advance an account to be designated "Commonwealth Census Account" will be opened in an approved bank.

This account may be operated on by cheques signed by the State Supervisor in his official capacity only.

The account must not under any circumstances be overdrawn.

A cash book will be furnished for the purpose of recording the operations on the account.

# 3.—TRAVELLING EXPENSES AND COST OF CONVEYANCE.

Each State Supervisor will be paid travelling expenses at the rates applying to him in his State official capacity.

State Supervisors will have authority to travel or to order their officers to travel, but each such case must be reported to the Commonwealth Statistician.

Conveyance.—A book of 25 orders will be issued to each State Supervisor for authorised travelling (rail, coach, or steamer).

Cost of Conveyance.—The following rates will be allowed :-

- (1) If by railway or sea, the actual fare.
- (2) If by road, where public conveyances are available, the actual fare only will be allowed. Where it is requisite to hire a special conveyance, 6d. per mile each way will be allowed, or, where this rate is insufficient, special representation should be made to the Commonwealth Statistician.

# 4.—POSTAGE STAMPS.

Each State Supervisor will be furnished with a supply of postage stamps for letters and telegrams for himself and his Enumerators.

Each State Supervisor shall, when necessary, requisition the Commonwealth Statistician for a supply of postage stamps. On receipt of advice of approval, the State Supervisor shall make application to the Deputy Postmaster-General for the supply.

Each State Supervisor shall keep a "Stamp Account" in a book as per Appendix.

Issues shall be checked daily by the State Supervisor, who shall initial against the daily total as evidence of the correctness of the credit claimed.

# 5.—EXPENDITURE SUCH AS PRINTING, CLERICAL ASSISTANCE, ETC.

The authority of the Minister for Home Affairs, through the Commonwealth Statistician, must be obtained for expenditure, such as printing, clerical assistance, &c., prior to any liability being incurred.

Cases of Emergency.—In cases of extreme urgency, where it may not be practicable to obtain the authority of the Minister for Home Affairs for an expenditure which is requisite for the proper and efficient conduct of the Census, the State Supervisor may incur the expenditure in anticipation of Ministerial approval; but in each such case he must at once forward to the Commonwealth Statistician an application for authority, and attach thereto a concise report of the circumstances.

Clerical Assistance.—Persons engaged for clerical assistance must be selected from the Register in the office of the Public Service Inspector; and the Secretary for Home Affairs, through the Commonwealth Statistician, must at once be advised of the names of such persons and the dates of their commencing duty.

Orders for services other than those paid for by petty cash will be issued by the Commonwealth Statistician.

# B.—ENUMERATORS.

#### 1.—REMUNERATION.

Each Enumerator will be paid a retaining fee of £10 10s., and such other remuneration as may by the Minister for Home Affairs be authorised.

#### 2.—TRAVELLING EXPENSES.

Each Enumerator travelling under authority from a State Supervisor will be paid personal expenses at the rate of 12s. per diem of 24 hours.

When travelling by steamer or other vessel in which the fare paid includes subsistence, one-fourth of the ordinary rate (viz., 12s. per diem), that is to say, 3s. per diem will be allowed.

# 3.—COST OF CONVEYANCE.

The following rates will be allowed:-

- 1. If by railway or sea, the actual fare.
- 2. If by road, where public conveyances are available, the actual fare only will be allowed. Where it is requisite to hire a special conveyance, 6d. per mile each way will be allowed, or where this rate is insufficient, special representation should be made to the State Supervisor.

# 4.—POSTAGE STAMPS.

Each Enumerator will be furnished by the State Supervisor with a supply of postage stamps for outward letters and telegrams, and for payment for letters and telegrams received from the Collectors.

Each Enumerator shall, when necessary, requisition the State Supervisor for a supply of postage stamps, and on the receipt of the supply shall forward an acknowledgement to the State Supervisor.

Each Enumerator shall keep a "Stamp Account" in a book as per Appendix.

## C.—COLLECTORS.

#### 1.—CONTRACT FOR SERVICE.

The Enumerator will obtain from each Collector engaged by him an agreement in writing to serve in that capacity in connection with the Census at the rates prescribed therein.

## 2.—LETTERS AND TELEGRAMS.

Each Collector shall forward all correspondence with the Enumerator, or State Supervisor, in envelopes supplied for that purpose. Postage stamps for these will not be required, since the postage will be paid by the Enumerator or State Supervisor on receipt.

Telegrams sent by the Collector to the Enumerator or State Supervisor must be marked "Collect," and he must produce to the Telegraph Officer his letter of authorisation as evidence of his appointment.

## D.—APPENDIX.

# POSTAGE STAMP ACCOUNT.

Date.		Part		culars.	Dr.			Cr.							
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										3	••		3		
Oct.	1	То	Balance	• •		••	••	••		1	17	••		,.	,

# APPENDIX 8.

# INSTRUCTIONS TO CENSUS ENUMERATORS.

# A.-PRELIMINARY.

#### CENSUS COLLECTION ON CARDS.

1. Your attention is specially drawn to the fact that on the present occasion the collection of the Census data will be effected on cards, instead of on schedules, as on former occasions. For every dwelling there will be one or more "Householders' Cards" (B), containing a description of the dwelling and a summary of the inmates; and one "Personal Card" (A) for each inmate. Each personal card will be accompanied by a printed list of "Instructions" (C) for guidance in filling in the cards. The cards and instructions are enclosed in one or more "Envelopes" (D), and throughout these instructions, where a "Householder's Schedule" is referred to, that term signifies the number of householders' cards and personal cards which are required for a dwelling. The "Instructions" and "Envelopes" are supplementary to the Schedule, and have been adopted for the greater convenience of householders and collectors. (See section 22 hereinafter).

#### POLICE ASSISTANCE.

2. Due notice will be forwarded to you later of the number of police constables (if any) which the Government of your State may have made available for the work of collection in your Census District.

# B.—DEFINITION OF COLLECTORS' DISTRICTS.

#### BOUNDARIES OF CENSUS DISTRICTS.

3. The boundaries of your Census District, shewn on the plans forwarded to you, are those that have been agreed upon between the Commonwealth Statistician and the Supervisor of your State.

#### CENSUS REQUISITES FORWARDED.

- 4. To enable you to commence your duties, the Census Supervisor of your State will forward to you-
  - (a) Copies of Enumerator's Schedule (A).
  - (b) Copies of Enumerator's Schedule (B).
  - (c) Form of Receipt (Census Form No. 24), to be signed and at once returned to your Supervisor.

# BOUNDARIES SHEWN ON PLAN.

5. The boundaries of your Census District will be found clearly defined in the map in broad red coloured lines.

The boundaries of the Commonwealth Electoral Divisions are marked in green, those of the State Electorate Districts in blue, those of the State Electoral Provinces in broken blue lines, those of Counties in yellow, those of Municipalities or other Local Government areas in neutral tint, and those of Municipal Subdivisions (Wards or Ridings) in neutral tint, broken line.

# MAPS TO BE CAREFULLY STUDIED.

6. Your first duty as an Enumerator will be to make a careful study of your maps, so as to enable you to suggest a scheme for the division of your district into Collectors' Districts. This should be done without delay, so that your proposals may be duly considered and approved, and maps of each Collector's District prepared for the use of Collectors.

# INSTRUCTIONS TO BE FOLLOWED.

7. In performing this duty you will kindly bear in mind the following points, and adhere as closely as possible to the principles here laid down for your guidance.

# DIVISION INTO COLLECTORS' DISTRICTS.

8. The whole of your Census District is to be divided into Collectors' Districts in such a manner as to allow of the duties of distribution and collection of the Census Schedules being performed by one Collector in each district within the time allotted to him for such purpose.

# SUBDIVISION NOT DEPENDENT ON NUMBER OF POLICE AVAILABLE.

9. In the first instance, when considering the subdivisions of your district, you are in no way restricted by the number of police (if any) who may be available to act as Collectors, as the appointment of Collectors will be separately dealt with after the Collectors' Districts have been defined.

# NO PART OF CENSUS DISTRICT TO BE UNACCOUNTED FOR.

10. You will bear in mind that the various Collectors' Districts into which you divide your Census District, must together form the whole of that district, and that no part is to be left unaccounted for on the assumption that it is uninhabited or for other reasons, and also that a Collector's District should, wherever practicable, consist of one continuous portion of the State, and should not, except in the case of an island or islands, be made up of two or more detached parts.

# POINTS TO BE PARTICULARLY CONSIDERED IN ALLOTTING COLLECTORS' DISTRICTS.

11. The Census District must be so divided in regard to all municipalities and towns, and also to other populous centres, as to admit of all schedules being distributed during the four days preceding Sunday, 2nd April, and collected during the eight working days following on that date. In the scattered country districts more time may be allowed, but the subdivisions should be such that it must be possible, even in the most remote part, to collect all the returns by the 24th of April, at the very latest.

The number of days that, in your opinion, should be allowed each Collector as sufficient for the distribution and collection of his schedules must be carefully considered and entered by you in the Enumerator's Schedule (A) before that document is returned for approval. The actual Census day (2nd April) should not be taken into account, as the distribution should be completed before and the collection commenced after that day.

Except under special circumstances, payment to collectors will be allowed only for the number of days thus allotted for distribution and collection in each case.

In the plan of the Census District which has been allotted to you, the boundaries of various electoral and other divisions are shewn, and must be taken into account in fixing the boundaries of your Collectors' Districts. These boundaries comprise those of Counties, Parishes or Hundreds, Commonwealth Electoral Divisions, State Electoral Districts, State Electoral Provinces, Municipalities, and in certain cases, Municipal Wards. Wherever practicable, it is desirable that the boundary of a Collector's District should not cross any of the boundaries thus shewn. Where in any case strict compliance with this provision would, in your opinion, result in unduly small Collectors' Districts being allotted, it may be departed from, but the number of such boundaries crossed in any single instance should be as small as practicable.

#### DISTINGUISHING LETTER TO BE GIVEN TO EACH COLLECTOR'S DISTRICT.

12. A distinguishing letter must be given by you to each Collector's District, and duly recorded in the Enumerators' Schedule (A), the lettering of the Collectors' Districts to run from A onwards.

#### DENSITY OF POPULATION TO BE TAKEN INTO ACCOUNT.

13. In apportioning Collectors' Districts you must consider the distance to be traversed by the Collector in going from dwelling to dwelling, and a district may therefore comprise more dwellings when they lie near together, and fewer when they lie far apart.

#### NUMBER OF INHABITED HOUSES TO BE ALLOTTED TO A COLLECTOR.

14. Thus, in a town where the houses adjoin or are only a few yards apart, from 150 to 200 inhabited houses may be included in each sub-district, whilst in suburban districts and villages or townships where the dwellings are moderately contiguous, although farther apart than in a closely-built town, the number may be from 100 to 150; in the more settled agricultural districts where there is occasionally a distance of more than half-a-mile between one dwelling and the one nearest to it, the number may be from 50 to 100; and in the more scattered districts where intervals of 2 miles or upwards occasionally intervene between the dwellings, less than 50 may be included in a sub-district. Due consideration must, however, also be given to the collector's method of travelling.

# SPECIAL ARRANGEMENTS FOR SCATTERED POPULATION.

15. As regards the arrangements for collecting in scattered country districts, or enumerating small bodies of miners engaged in prospecting, &c., the special circumstances of each locality must be taken into account, both as regards the time to be allowed and the number of habitations to be allotted to each collector.

# COLLECTION OF SHIPPING POPULATION.

16. In coastal districts where it will be necessary to collect Census Schedules from vessels in the various ports, you must remember, when subdividing your Census District, to make the necessary arrangements for providing one or more Collectors' Districts for the shipping in port, fishing fleets, pearling fleets, &c., according to requirements.

# ENUMERATION OF ISLANDS OFF COAST.

17. Arrangements must also be made for the enumeration of the inhabitants on any of the islands off the coast of your district, and suggestions as to best way of so doing should be submitted to your Supervisor as soon as possible for consideration and approval.

# RAILWAY TRAVELLERS.

18. Special arrangements will be made by your Supervisor for the collection of particulars relative to persons travelling on the railways.

# CARE TO BE TAKEN IN DEFINITION OF BOUNDARIES.

19. It is essential to the accuracy of the enumeration that the boundaries of the Collector's Districts be well defined and clearly described, so that there may be no room left for doubt as to the Collector's District to which any one portion belongs.

It is therefore impressed upon you that, wherever possible, well-marked, natural or artificial boundaries, such as rivers or creeks, roads, lines of railways, telegraph lines, &c., should be adopted. In cases where streets, roads, or rivers, are used as boundaries, the boundary-line must invariably be understood to run in the centre of the street, road, or river, so that the houses on one side will be in one Collector's District, and those on the other side in the Collector's District adjoining. Imaginary lines drawn from point to point on maps are not readily followed, and should only be adopted in cases where no others are available, or where such lines form the boundaries of existing divisions as mentioned in Instruction No. 11, above.

# ENUMERATION IN MUNICIPALITIES AND WARDS.

20. It is intended to show separately in the Census Report the population of all the municipalities, and, in certain cases, of the wards into which they may be divided, therefore the population actually living within their declared boundaries must be accurately ascertained. It is desirable that, wherever possible, each municipality or ward, if not too large, be constituted a Collector's District.

#### SUBMISSION OF SUBDIVISION FOR THE STATE SUPERVISOR'S APPROVAL.

21. Having carefully thought out and drawn up your scheme for this subdivision of your Census District in conformity with the foregoing instructions, you will then cause the boundaries of and letter given to each Collector's District to be clearly marked in pencil lines on the map or maps forwarded to you. A written description of the boundary lines of such Collector's Districts, and all other details of information required to complete Enumerator's Schedule (A) should also be made out in duplicate. This having been done, the maps, and one copy of Enumerators' Schedule (A), must be at once transmitted to your Supervisor for consideration and approval, one copy of the Enumerator's Schedule (A) being retained by you for reference. Upon the receipt of the above-mentioned documents, your suggestions will receive immediate consideration, and after approval the necessary maps of your district and of each Collector's District, &c., will be prepared and forwarded to you.

# LIST OF SCHEDULES REQUIRED.

22. It will be necessary for you when completing Enumerator's Schedule (A), to give in the columns provided for such purpose a definite statement as to the number of Householders' Schedules you will require for the enumeration in each sub-district. This number can be approximately gauged from the fact that a Householder's Schedule will be required for each separate household, and that, under Section 10 of the Census and Statistics Act 1905, "where a dwelling is let, sub-let, or held in different apartments and occupied by different persons or families, each part so let, sub-let, or held and used for the purpose of human habitation, shall be deemed a dwelling-house."

In estimating, however, the number required, due allowance must of course be made for a certain percentage of Schedules being spoilt, lost, &c., and therefore a fairly liberal quantity should, in the first instance, be asked for to prevent any possibility of the supply running short during the progress of the distribution or collection, as it must be borne in mind that it may be impossible to furnish a second supply in time, should such a necessity arise.

# NECESSITY FOR PROMPT COMPLIANCE WITH INSTRUCTIONS.

23. In view of the great importance of the forthcoming Census, and considering also the urgent necessity for an early and satisfactory completion of all preliminary arrangements, reliance is confidently placed in your ready compliance with all instructions which may be issued, with the object of making this national undertaking an unqualified success. Later on, the requisite cards and other forms will be forwarded in good time.

#### C.—SELECTION AND APPOINTMENT OF COLLECTORS.

#### RETURN OF APPROVED MAPS.

24. When your Enumerator's Schedule (A) and the maps of your Census District with the proposed divisions of same into Collectors' Districts marked on them have been examined, the transcript of the Schedule, containing such alterations or additions as it has been considered either desirable or necessary to make, will be returned to you. The maps, with the approved boundaries of Collectors' Districts marked on them in narrow red lines, will be returned under separate cover, which will also contain additional sectional maps to enable you to provide each of your collectors with a separate map of his own district (a list of maps sent will be attached).

# SELECTION OF COLLECTORS.

25. On receipt of the maps, you will proceed with the selection of persons qualified and in other respects suitable for the position of collectors, bearing in mind that it will be necessary to obtain the services of as many collectors as there are districts in your Census District.

# SERVICES OF POLICE.

26. A list giving the names and addresses, &c., of those police officers (if any) who will be available for Census work in your district, will also be sent to you.

# ALLOTMENTS OF DISTRICTS TO POLICE COLLECTORS.

27. With a view to selecting the Collectors' Districts most suitable and convenient for each of the police collectors, it is suggested that you at once place yourself in communication with the officer commanding the police in your district, and obtain his views and suggestions at an early date. This will, of course, be necessary only in connection with the allocation of Collectors' Districts so far as the police collectors are concerned.

## ALLOTMENT OF DISTRICTS TO CIVILIAN COLLECTORS.

28. For the remaining Collectors' Districts the services of civilians must be obtained, and in selecting the most suitable persons for the appointment, the principal fact to be borne in mind is the absolute necessity of your being able to place implicit reliance on their strict adherence to the instructions contained in the following paragraphs.

# QUALIFICATIONS OF COLLECTORS.

29. To enable him to fulfil his duties satisfactorily in every respect the collector must be a person of intelligence and activity, must neither be too young nor yet too old, must read and write well, and must be sufficiently healthy and strong to undergo the exertion of performing his task with promptness. He must be of temperate habits and of sufficiently good address to convey all the requisite information concerning the Census in a manner calculated to command the goodwill and co-operation of all concerned. It will be necessary that he should be thoroughly acquainted with the Collector's District in which he is required to act, and he should therefore, by preference, all other qualifications being equal, be selected from among those applicants who have resided in the district for some time, and whose business has brought them into frequent and direct personal contact with its inhabitants.

# RESIDENCE OF COLLECTORS.

30. It is further desirable that each collector should live in or near his own Collector's District, so that he may not have the additional labour of going far from home before he can begin his duties. This rule, however, is not one to which a rigid adherence is necessary, but you will in this respect exercise your own discretion, remembering that character and fitness are qualities to be considered of paramount importance.

#### INTERPRETERS.

31. Should there be any large number of Asiatics or other foreigners in your district who, in your opinion, are likely to be ignorant of the English language, you will endeavour, with the sanction of your Supervisor, to obtain, where necessary, the services of persons qualified to act as interpreters to accompany the collectors. There is, of course, nothing to prevent a person able to interpret, if in other respects suitable, being appointed a collector.

#### RATES OF REMUNERATION.

32. Except where otherwise specially authorised, it is proposed to remunerate collectors acting on foot at the rate of 10s. per diem, collectors acting on bicycles at the rate of 15s. per diem, and collectors acting on horseback at the rate of 20s. per diem; bicycles, horses, vehicles, petrol, and fodder to be provided by the collectors. Should it be found impossible to obtain suitable collectors in some of the remoter districts at the above-mentioned rates, and if it is absolutely necessary to offer higher rates to secure competent men, it will be your duty to state fully the reasons for so doing when sending in your "Enumerator's Schedule" (B).

This will also apply in cases where it will be necessary for a collector to hire camel or boat, or where any exceptional circumstances occur.

#### TIME TO BE ALLOWED.

33. In making arrangements with the civilian collectors, you will understand that no payment is to be allowed them for any time which may be occupied in receiving instructions from you or in giving up returns after the Census is over. An additional sum of 5s. will, however, be allowed to each collector for the work of completing and summarizing the entries in the Collector's Compilation Book.

Before submitting the name of any person for appointment as collector, it must be ascertained whether he will agree to perform the work of the distribution and collection of the Schedules within the number of days you have already suggested in "Enumerator's Schedule" (A) as being sufficient for the performance of the duties in the district for which he is recommended for appointment. He must be given to understand that the maximum payment which will be made to him will be for that number of days, with the additional 5s. mentioned above.

# LIST OF PROPOSED COLLECTORS TO BE SENT TO STATE SUPERVISOR.

34. Having obtained a sufficient number of persons willing to serve as collectors in your district, and having satisfied yourself as to their fitness by making the requisite inquiries, you should, as soon as possible, prepare and send in a list for the consideration of the State Supervisor of Census on the form headed "Enumerator's Schedule" (B), stating the name, age, and occupation of such person, and the letter denoting the Collector's District to which it is proposed to appoint him, and other required particulars.

### NECESSITY FOR PROMPT ATTENTION TO INSTRUCTIONS.

35. Kindly give this matter your earliest possible attention, and return to the State Supervisor Schedule (B) duly completed, so as to allow of all details being attended to without loss of time.

# D.—FINAL INSTRUCTIONS.

## GENERAL.

36. While the preceding instructions to Census Enumerators, namely (B) Definition of Collector's Districts, and (C) Selection and Appointment of Collectors, are being complied with, it will be your duty to make yourself thoroughly conversant with all the requirements connected with the actual taking of the Census, as set forth and indicated by the provisions of the Census and Statistics Act 1905, and in all instructions issued by the Commonwealth Statistician for the guidance of Enumerators and Collectors, and also in the instructions contained in the Householder's Schedule, &c.

# PRELIMINARY WORK TO BE COMPLETED IN GOOD TIME BEFORE CENSUS DAY.

37. As the Census is to be taken as on the night of Sunday, 2nd April, 1911, you are required to take the preliminary steps pointed out in these instructions as long beforehand as possible, and to cause all necessary preparations to be completed in good time, so that nothing will remain unsettled or undecided on Census day.

# APPLICATION TO BE MADE TO STATE SUPERVISOR WHERE DOUBT EXISTS AS TO DUTIES

38. If you are in doubt as to any part of your own or a collector's duties, or should not thoroughly understand the various forms or instructions, it will be necessary for you to at once communicate with your State Supervisor for advice, taking care to make use of the telegraph only when time will not permit of communicating by letter.

# NEIGHBOURING ENUMERATORS TO BE CONSULTED WHERE DOUBT EXISTS AS TO EXACT BOUNDARIES.

39. In case of any doubt as to the exact boundary-line between your own and an adjoining district, you are recommended to communicate with the Enumerator of that district, and to enter into such arrangements as will enable the collectors acting on either side to locate the common boundary-line, and to act together, so that neither omissions nor overlapping may occur. You are also requested to take proper precaution that your collectors act in concert with each other, and with the collectors of adjoining districts.

## PRECAUTION TO BE TAKEN TO AVOID OMISSIONS OF LOCALITIES OR INHABITANTS.

40. Prior to the commencement of the actual enumeration, you should take every precaution, and make use of the knowledge you possess or are able to gain from others relating to each Collector's District, so that the instructions you issue will effectively prevent any localities or inhabitants being overlooked by the collectors.

# ENUMERATOR TO MAKE HIMSELF FAMILIAR WITH COLLECTORS' DUTIES.

41. The principal duties of the collectors are defined in Sections 8 to 15 of the Census and Statistic Act 1905, copies of which will be sent to you for your own use, and for the use of your collectors, and in the more detailed instructions to collectors, which have been drawn up for their guidance, and with these sections and instructions you should make yourself thoroughly familiar.

# CENSUS SCHEDULE, BOUNDARIES OF SUB-DISTRICTS, AND DUTIES TO BE EXPLAINED TO COLLECTORS.

42. You should, some time before the actual distribution of Schedules commences, explain to such of your collectors as it is practicable for you to see, their duties, and go over the map of each Collector's District with them, carefully pointing out and explaining the boundaries of the district, so as to prevent any misconception on their part, either in connexion with the details of their duties or in regard to the exact boundaries of the districts assigned to them. You should not only fully explain to your collectors the Householder's Schedule and the manner in which the enumeration is to be performed, so that they may adopt a uniform system in carrying out their duties, but you should also take the opportunity of ascertaining whether the instructions to collectors are properly understood by each, and of giving any explanation they may require with regard to any matters which may have been left unexplained or doubtful. Where the district allotted by you to any collector comprises portions of two or more of the divisions shewn on the plan of your Census district, such as portions of two Commonwealth Electoral Divisions, portions of two Counties, &c., care must be taken to impress upon the collector the necessity for carefully ascertaining the position of the boundary between these two divisions, and for correctly inserting the name of such division in the cards delivered by him.

#### FORMS, ETC., TO BE SUPPLIED TO COLLECTORS IN GOOD TIME.

- 43. Every collector must, within four days next preceding Sunday, 2nd April, 1911, except in cases where a longer time has been approved and directed by the State Supervisor of the Census, cause to be left at every dwelling as defined by Section 10 of the Act, within his Collector's District, a copy of the Householder's Schedule to be filled up. It is therefore necessary that you should in ample time give to each collector a sufficient supply of cards, instructions, and envelopes to enable him to leave a Householder's Schedule at each dwelling in his Collector's District, together with some spare ones to provide against miscalculations or any losses or defacements. You should also see that each collector is supplied with:—
  - (1) His certificate of appointment.
  - (2) A copy of Instructions to Collectors.
  - (3) A complete map of his district.
  - (4) A copy of Collector's Compilation Book.
  - (5) A copy of Collector's Record.
  - (6) Necessary articles of stationery.
  - (7) A bag for holding Schedules (if required).
  - (8) An Enumerator's Schedule (C) specifying the number of Schedules and other things you hand over to the collector for use in connection with the Census.

On a duplicate of the Schedule (C) you should obtain a receipt from the collector for all cards and other things he has received. After the work has been completed, you are to obtain from each collector an account of the disposal of these cards and other things, and to take over from him any balance remaining with him.

# CARDS AND ENVELOPES TO BE MARKED AND NUMBERED PREVIOUS TO BEING HANDED OVER TO HOUSEHOLDERS.

44. Every envelope and every Householder's and Personal Card will have the name of the State printed on it, while the number of the Census District will have to be stamped thereon by you. It will be the duty of your collectors to see that every Householder's Card before being left at the dwelling, has the name of the County, Parish, or Hundred, Federal Electoral Division, State Electoral Province, State Electoral District, Municipality or Ward, the letter of Collector's District, and the mesh number written or stamped in the place provided for that purpose. The envelope must be filled in, the Householder's Card numbered, and the name of town, &c., and street, with number and name of dwelling written on card by the collector on delivery. If the Personal Card has not been numbered by the householder, this must be done by the collector when he is collecting the Schedules. He must also at that time complete the entries on the envelope as to the number of cards.

# TERMS OF ENGAGEMENT TO BE IMPRESSED UPON COLLECTORS BEFORE COMMENCEMENT OF THE WORK.

- 45. Before the collector commences his actual duties, you should take care to impress upon him the following, viz.:—
  - (a) That having once accepted the office of collector and signed the agreement, he will not, under Section 22 of the Census and Statistics Act 1905, be subsequently at liberty to refuse the position or neglect the performance of his duties without just cause, the penalty for refusal being £20 according to the Act cited.
  - (b) That no person employed on the Census will be entitled to payment unless he shall have faithfully performed his duties.
  - (c) That no payment in excess of five shillings will be allowed for the time taken in making up Compilation Books and Schedules after the Census is over.
  - (d) That under Section 24 of the Census and Statistics Act 1905, the Householders' Schedules and all other Census forms are confidential documents, and that any officer employed under the Commonwealth Statistician divulging the whole or any part of the contents of any form filled up in pursuance of the Act, or any information furnished in pursuance of the Act, renders himself for every such offence liable to a penalty of £50.

# VESSELS ARRIVING IN PORT AFTER CENSUS NIGHT.

46. In addition to obtaining Census Schedules from all vessels in port in the Commonwealth on Census night, it will be also necessary for you to make arrangements for collecting the requisite Census information regarding all persons on board any vessel other than a warship, which on Census night was on a voyage from any port within the Commonwealth, and of which the first port of call after sunrise on Monday, the 3rd of April, is in your district, such vessel to be treated in the same manner as if it had been in port on Census night. In case of a vessel arriving after sunrise on Monday, 3rd of April, from any port outside the Commonwealth, Census Schedules will not be required. You should also cause the master of each vessel leaving any port in your district for any other port in the Commonwealth during the week preceding Sunday, the 2nd April, to be supplied with Census Schedules, so as to admit of a return being furnished without delay at the next port reached subsequent to Census night.

The collection on board any warships which may be in port in your district will be arranged for by your Supervisor.

#### VACANCIES IN POSITIONS OF COLLECTORS.

47. Should you deem it advisable for any reason to recommend the removal of a collector after his appointment, you should at once submit your reasons to the Supervisor of your State, who, if he concurs, will then cause such collector to be removed. If any collector should be incapacitated from acting, you must at once take the necessary steps to procure a substitute, whom you may appoint temporarily, pending the approval of the Supervisor. You should report any vacancy, by telegram if necessary, to the Supervisor, and submit a proposal how to fill it, in order that such appointment may be duly approved without delay.

#### VACANCIES IN POSITIONS OF ENUMERATORS.

48. Should you be prevented by sudden illness or other unavoidable cause from carrying out your duties in connection with the Census, you are requested to at once communicate the fact to the Supervisor of your State, by telegram if possible, but should there not be sufficient time to enable the Supervisor to appoint a successor, you should at once depute some fit and proper person to act for you, who, if approved of, will be subsequently appointed in the ordinary course.

# CENSUS SCHEDULES AND OTHER FORMS TO BE EXAMINED BY ENUMERATORS.

49. You should bear in mind that you are required to receive the Householders' Schedules from your collectors as early as practicable after each of them has completed his work of collection. As they are received, you must examine them separately and see that they are properly filled in and that the collectors have faithfully performed their duties, and in case of mistakes or omissions of any kind, you must insist on their being rectified or supplied, as the case may be. You must examine and satisfy yourself that the special distinguishing letter of the Collector's District, as well as the requisite names of County, Electoral Division, &c., are duly and properly filled in, and that the number of Personal Cards in each envelope agrees with the summary shewn on the Householder's Card. Any defect must be rectified before the Schedules are sent on to the Supervisor. You will also examine the Collectors' Compilation Books so as to ascertain that they have been correctly filled in before you forward them on. Each Collector's Compilation Book must be signed by you on the last page, and the correctness of the entries certified. As you have the selection of your civilian collectors, you will naturally take upon yourself the responsibility for their being competent to perform their work properly.

#### PRECAUTIONS CONCERNING POSSIBLE OMISSION OF TRAVELLERS.

50. In all cases where you have reason to believe that travellers or others have camped out in any part of your Census District on the night of Sunday, the 2nd of April, and where you have received no returns respecting them, you must be particular to inquire carefully into the matter. You must also examine the returns of travellers, &c., sent in by the different collectors, and if you have reason to believe that all have not been taken into account, you should forward your estimate of the possible omissions, together with the data on which such estimate is founded.

# INQUIRY TO BE MADE OF ALL VESSELS REACHING PORT WITHIN A WEEK FOLLOWING CENSUS DAY.

51. The arrival of every vessel in any port of your district from any port within the Commonwealth is to be closely watched for the first week after the night of the Census, and inquiries immediately made in each case as to whether a Census Schedule has been filled in, and if so, to whom it has been delivered. If not, the Schedule must be filled in with all the requisite particulars before passengers or others leave.

# TRANSMISSION OF PRELIMINARY RETURNS TO COMMONWEALTH STATISTICIAN AND TO STATE SUPERVISOR.

52. Immediately upon receipt of the complete returns from each Collector's District, you will make arrangements for checking the summary in the Collector's Compilation Book, so far as the number of males and females is concerned, and at the earliest possible moment you will send by letter (or by telegraph, if specially instructed to do so) both to the Supervisor of your State and the Commonwealth Statistician, the total number of males and females respectively in each Collector's District, exclusive of aboriginals, to enable a preliminary statement of the population to be issued as early as possible. These letters or telegrams should be sent as the returns for each Collector's District come to hand, and should not be kept back until the whole Census District is complete.

# TRANSMISSION OF COMPLETE RETURNS TO STATE SUPERVISOR.

53. You will carefully attend to the instructions respecting the time for the transmission of the Schedules and other documents to the Supervisor of your State, taking care that every parcel has clearly recorded on it the number of the Census District and the letter of the Collector's District to which it belongs. The returns should include Collector's Compilation and Record Books, the former of which should be certified to by you, on the last page, as to their correctness, and should also be accompanied by a summary for the district on Enumerator's Schedule, and a statement as to the number of cards, &c., made out on Enumerator's Schedule.

# UNUSED FORMS TO BE RETURNED TO STATE SUPERVISOR.

54. After the whole of the work connected with the Census is completed, you should cause to be returned to the Supervisor all unused forms, schedules, or any other articles supplied in connection with the work.

# LETTERS NOT TO BE INCLUDED IN PARCELS.

55. Letters are not to be enclosed in the parcels of Schedules or other documents, as such parcels may occasionally not be opened for some days after their arrival at the Census Bureau.

# ENUMERATOR NOT TO INCUR EXPENDITURE EXCEPT UNDER AUTHORITY OF STATE SUPERVISOR.

56. Except in cases of extreme emergency, you are not to incur any liability on behalf of the Government, nor commit the Government to any expenditure, without having first referred to your State Supervisor on the subject, and having through him obtained the necessary authority.

# SENDING IN OF VOUCHERS.

57. When forwarding the Census Schedules to the State Supervisor, you will at the same time send in a voucher on Commonwealth Form No. 9 for the amount for which you have yourself contracted to act as Enumerator. Each of your collectors, on completion of his work, will forward to you on Commonwealth Form No. 9, an account for the amount due to him. On receipt of these accounts, you will carefully examine them and certify them as correct. You will then forward them to the postmaster, at the post office previously notified to you, for payment, and notify the collectors when the accounts have gone forward for payment.

In examining the collectors' accounts you will have to be particularly careful to ascertain that where collectors have been employed to act otherwise than on foot, and where an increased remuneration per diem is allowed on that account, the modes of conveyance stipulated for were actually used, and that the Government is not improperly charged with the extra allowance when the work has been performed on foot.

#### ARRANGEMENTS WITH POSTAL AUTHORITIES.

58. You will be furnished by your State Supervisor with a supply of postage stamps for outward letters and telegrams, and for payment for letters and telegrams received from the collectors. You will, when necessary, requisition the State Supervisor for a supply of postage stamps, and on the receipt of the supply forward an acknowledgement to the State Supervisor. You will keep a "Stamp Account" in the form shewn in the Appendix to "Financial Instructions," of which a copy is forwarded to you, together with the present Instructions.

### NO PARTICULARS AS TO RESULTS TO BE DIVULGED BY ENUMERATORS.

59. It must be clearly understood that no summary or abstract of the information collected in your district is to be supplied by you to the press, or to any individual whatsoever, excepting the Commonwealth Statistician or the State Supervisor of the Census, but that any information with regard to the result of the Census which it may be considered desirable to publish will be furnished by the State Supervisor of the Census, to whom all inquiries should be referred.

(Signed) G. H. KNIBBS,

Commonwealth Statistician.

Commonwealth Bureau of Census and Statistics, Melbourne, 30th September, 1910.

# APPENDIX 9.

## INSTRUCTIONS TO COLLECTORS.

# UNDERTAKING AND DECLARATION TO BE SIGNED BY COLLECTOR ON APPOINTMENT.

1. When your appointment as a collector has been approved by the State Supervisor, you will be required to give an undertaking which will be submitted to you by the Enumerator. That document, Census Form No. 16, contains in specific terms the conditions under which you are engaged. Under Section 7 of the Census and Statistics Act 1905, you will also have to make a declaration of secrecy before a Justice of the Peace or a Commissioner for Affidavits. This declaration will be made on Census Form No. 11.

# COLLECTOR TO MAKE HIMSELF THOROUGHLY ACQUAINTED WITH HIS DUTIES AND TO CONSULT ENUMERATOR IN CASE OF DOUBT.

2. You will receive from the Enumerator a copy of these instructions, which you must read over and thoroughly master before you commence your duties. You must also make yourself thoroughly acquainted with the instructions accompanying the Householders' Schedules, and with those sections of the Census and Statistics Act, principally sections 8 to 15, which particularly pertain to you. A copy of the Act is forwarded to you with these instructions. You should also make yourself acquainted with the manner in which the entries should be made by the householder and others, and if the directions given are not absolutely clear to you, you should, without delay, consult your Enumerator, whose duty it is to afford you the requisite explanation.

# CENSUS COLLECTION ON CARDS.

3. Your attention is specially drawn to the fact that on the present occasion the collection of the Census data will be effected on Cards, instead of on Schedules, as on former occasions. For every dwelling there will be one or more "Householders' Cards" (B), containing a description of the dwelling and a summary of the inmates, and one "Personal Card" (A) for each inmate. Each Personal Card will be accompanied by a printed list of "Instructions" (C) for guidance in filling in the cards. The cards and instructions are enclosed in one or more "Envelopes" (D), and throughout these instructions where a "Householder's Schedule" is referred to, that term signifies the number of Householders' Cards and Personal Cards which are required for a dwelling. The "Instructions" and "Envelopes" are supplementary to the Schedule, and have been adopted or the greater convenience of householders and collectors.

#### MAP OF COLLECTOR'S DISTRICT TO BE SUPPLIED TO COLLECTOR.

4. You will be supplied with a map of your Collector's District to assist you in thoroughly comprehending its boundaries, and in ascertaining whether you have visited all parts of it. Should you, however, still entertain any doubt about the boundaries, you should confer with your Enumerator, and so arrange that you neither omit any portion of your own district nor enter that of any other collector.

The names of the various electoral and other divisions in which the district allotted to you is situated are shewn on the plan of your district, and are to be carefully inserted by you on all the Householders' Cards delivered. These divisions comprise counties, parishes, or hundreds, Commonwealth electoral divisions, State electoral districts, State electoral provinces, municipalities, and, in certain cases, municipal wards. Where the district allotted to you consists of portions of two or more of these divisions, such as portions of two or more counties, or portions of two or more Commonwealth electoral divisions, &c., care must be taken by you to ascertain the exact position of the boundary between such divisions, so as to insure the correct entry by you on the cards delivered. In every case the mesh number must be carefully inserted.

# HOUSEHOLDERS' SCHEDULES, COMPILATION AND RECORD BOOKS, STATIONERY, ETC., TO BE SUPPLIED TO COLLECTOR.

- 5. The Enumerator will supply you, for use in connection with the Census, with the following forms and other articles to aid you in the performance of your duties:—
  - (1) The requisite number of Householders' Schedules, comprising (a) Householders' Cards and (b) Personal Cards, with the addition of (c) Instructions, and (d) Envelopes.
  - (2) A copy of Collector's Compilation Book.
  - (3) A copy of Collector's Record Book.
  - (4) A list of Schedules and other things to be accounted for by you to the Enumerator on Enumerator's Schedule (c).
  - (5) Necessary articles of Stationery.
  - (6) Bag for holding Schedules (if required).
  - (7) Your Certificate of Appointment.
  - (8) A complete Map of your District.

#### NUMBERING OF HOUSEHOLDERS' SCHEDULES.

6. The name of the State will be printed, and the number of the Census District will be stamped on all cards and envelopes issued to you. The name of county, parish, or hundred, Federal electoral division, State electoral district, State electoral province, municipality, and ward, the letter of Collector's District, the number of the Householder's Schedule, the name of town, &c., and street, with number or name of dwelling must be written on each Householder's Card prior to delivery. The blank spaces on Personal Cards and envelopes, with the exception of those referring to the number of cards, must be filled in by you when delivering the Schedules. The number of the Personal Card, if it has not been filled in by the householder, must be filled in by you when you are collecting the Schedules. At the same time, you must make entries on the envelope relating to the number of cards which it contains. Do not put blank cards or returned instructions in the envelopes when collecting the Schedules, and in all cases, when collecting, see that the number of completed Personal Cards agrees with the summary on the Householder's Card.

# DISTRIBUTION OF SCHEDULES ON OR BEFORE 2ND APRIL.

7. On the four days preceding Sunday, 2nd April, or at such time prior thereto as the Enumerator, on behalf of the Supervisor, may direct, you are to leave within your district at every dwelling (as defined in Section 3 of the Census and Statistics Act) one or more Schedules as required, care being taken to ascertain in each case the number of Householders' and Personal Cards and of envelopes which will be needed. Each such Schedule must contain one or more Householders' Cards, and as many Personal Cards as the householder estimates will at most be required. Each Personal Card must be accompanied by a set of the instructions for filling in the Householder's Schedule. When distributing the Schedules, you should explain the nature and importance of the returns required, and the obligation imposed by law upon each occupier to give a complete and accurate statement. You should also state that the Schedule will be called for on Monday, 3rd April, or as early as possible after that date, by which time it must be completed and ready to be delivered. You should strongly impress upon the householder the necessity for complying with this provision, informing him of the penalty incurred by non-compliance, and urging that special care should be taken to prevent the loss or defacement of the returns. You should also specially inform and impress upon persons in charge of hotels, lodginghouses, &c., that they will be required to give full particulars respecting every person who slept or abode on the houses, &c., that they will be required to give full particulars respecting every person who slept or abode on the premises under their control on the night of Sunday, 2nd April, and that they are similarly subject to penalty for non-compliance.

A number of births and deaths will, of course, occur during the night of the Census. As the hour of midnight is the exact time at which the population is to be determined, children born before twelve o'clock on the night of 2nd April should be *included*, and those born after twelve o'clock, that is, in the early hours of 3rd April, should be excluded. Persons who died before twelve o'clock on the night of 2nd April should be excluded, while those who were still alive at midnight, but died in the early hours of 3rd April, should be included.

# SCHEDULES FOR OUT-STATIONS TO BE FURNISHED BY PROPRIETOR OR PERSON IN CHARGE OF STATION.

8. Proprietors or persons in charge of pastoral holdings should be asked to furnish for every out-station in your Collector's District such particulars as would have been required of the occupier of such out-station if a Schedule had been left with him.

You should make careful inquiries at each station as to the number of Schedules needed for out-stations, and leave them, with instructions for their use, with the proprietor or person in charge. Where there is a separate tenement of any kind, either on the station or at out-stations occupied by any member of the establishment, full particulars relative to each such tenement and its occupants must be supplied in a separate Householder's Schedule.

# ENTRIES TO BE MADE IN RECORD BOOK.

When distributing the Schedules, the name of each householder with whom a Schedule has been left, together with the locality, the number of the Schedule, and the date of delivery, must be immediately entered in your Record Book, and the date when collected must be inserted when the Schedule is received duly completed. By doing this, you will be able to ascertain when all the Schedules delivered have been collected. In the event of a Schedule being lost or defaced "Lost, Schedule No.....substituted" (No. to be given) must be written in the remarks column.

# COLLECTION OF SCHEDULES ON OR AFTER 3RD APRIL.

10. On the morning of Monday, 3rd April, taking with you some blank cards and envelopes for the purpose of supplying any possible omissions in the distribution, or for use in place of any that may have been lost or defaced, you will proceed to revisit every dwelling or other place in your district at which you have left a Schedule, and you must continue your work on the following day or days until the whole of the forms which were distributed have been recovered. If you cannot complete the collection in your district within the time allowed by your Enumerator, you are still bound to continue until you have completed your work.

#### RETURNS TO BE CAREFULLY EXAMINED AND COMPLETED WHERE NECESSARY.

11. At each place visited, the Schedules previously left must be asked for, and when they are given up, you must ascertain if they contain all the particulars required, and if not, you must endeavour to obtain such further information as is necessary. You must be careful to ask if all the persons are accounted for who, on the night of the 2nd April, slept or abode in the dwelling or in the part thereof which is occupied by the person making the return.

# PERSONS RETURNING ON 3RD APRIL TO BE INCLUDED IN SCHEDULE IF NOT ELSEWHERE ENUMERATED.

12. Inquiries should also be made whether any one who was travelling or out at work during the night of the 2nd April returned to the dwelling on Monday, the 3rd April. If such is the case, and the person has not been elsewhere included, a Personal Card must be inserted in the same manner as if the person had slept or abode in the dwelling during the Census night, and the person must be duly noted in the summary on the Householder's Card.

#### ABSENTEES NOT RETURNING ON 3RD APRIL.

13. If any member of the household was absent on the night of the 2nd April, and did not return on Monday, 3rd April, inquiry must be made whether there is reason to suppose that in consequence of his having been travelling in the bush, out camping, fishing, or otherwise engaged, he is likely not to have been recorded on any Schedule. If this is considered probable, you should enter on a Personal Card and on a Householder's Card the full particulars concerning such person as far as they can be ascertained, with a note stating as definitely as possible the locality in which the absent person spent the night of 2nd April.

# TWO OR MORE SCHEDULES TO BE IN SOME CASES OBTAINED FROM THE SAME BUILDING.

14. You must notice whether a Householder's Schedule is a return for the whole building or for a part of it only, and in case the building is occupied by more than one family, you must obtain returns for the other part or parts of it upon separate Schedules. In large households, such as hotels, &c., more than one Householder's Card will often be required. These must be pinned together in the upper left-hand corner, and marked in the proper place "Householder's Card No.......(A), (B), &c." In such a case, the description of the building should be given on the top card only. Similarly, a sufficient supply of envelopes to contain the cards should be left, such envelopes to be marked "No......(A), (B), &c."

## SCHEDULE TO BE PLACED UNDER DOOR IF INMATES ARE ABSENT.

15. If in the case of a dwelling in which someone resides or appears to be residing, you find no one at home when you call, a Schedule should be placed under the door or left with a neighbour. If, on returning for the Schedule, you should again find no one at home, and if the papers have not been left out for you, you should call again and endeavour to meet the occupier. Should you be unable to do so after two or three attempts, you should fill in the Schedule from information obtained from the neighbours or from some other person acquainted with the inmates, in which case the dwelling may be considered as properly visited.

# CIVILIZED AND SEMI-CIVILIZED ABORIGINALS ONLY TO BE ENUMERATED.

16. All aboriginals and half-caste aboriginals who are civilized or semi-civilized, and who are either in employment or living in proximity to settlements are to be enumerated, care being taken that in every case a distinguishing abbreviation "Ab." (aboriginal) or "Ab. H.C." (aboriginal half-caste) as the case may be, is inserted after the word "Race" on line 10 of the Personal Card. You should ascertain the various particulars required as fully as possible, although it is probable that in many instances very little information will be obtainable. In every case, however, the sex must be stated. No attempt need be made to obtain any particulars concerning aboriginals in your district who are living in a purely wild state.

# COLLECTOR TO ASSIST HOUSEHOLDER, WHERE NECESSARY, IN COMPLETING RETURN.

17. If on inquiry for the Householder's Schedule it is delivered to you not filled in, or in an incomplete state, you must yourself fill in the requisite particulars after asking all the necessary questions. You should, if possible, see the head of the household for that purpose and obtain the details. In the absence of the head of the household, any other member possessing the requisite intelligence may supply the particulars required. It is also your duty to help those who, through being illiterate or from other causes, are unable to personally fill in their Schedule, and you may fill in any part or, if necessary, all the particulars for such persons. The informant, however, must, in each case, personally sign his name or attach his mark (which is to be witnessed by you) on the Householder's Card, as a guarantee that the particulars are authentic.

# SCHEDULE TO BE SUBSTITUTED FOR ANY LOST OR DEFACED.

18. If you are unable to receive certain of the Schedules you distributed by reason of their having been defaced or lost, you must put the requisite questions to the inmates, and from the answers given fill in the information required on one of the spare Schedules you have with you for the purpose. The substituted Schedule should be marked "Substituted for Schedule, No......" (giving the number of the Schedule lost or defaced).

# EVERY EFFORT TO BE MADE TO ASCERTAIN REQUIRED PARTICULARS.

19. In every possible instance, the full particulars required under each heading should be obtained, and you may enter "not stated" on any line only after every effort has, without success, been made to secure the required information. This rule must be observed as regards all omissions in the Schedule.

# PARTIAL INFORMATION TO BE SUPPLIED WHEN FULL INFORMATION IS NOT AVAILABLE.

20. You must not, however, omit to fill in a Personal Card and to enter persons on the Householder's Card, if you cannot obtain all the information respecting them. If, for instance, you obtain information that a person, who has since gone away and whose name is unknown, slept in a dwelling or camped out in a certain place on the night of the 2nd April, you should fill in a Householder's and a Personal Card for such person, writing "not known" on line 1 of the Personal Card, but stating the sex and adding such other particulars as to age, &c., as can be ascertained or estimated.

# REFUSAL TO SUPPLY INFORMATION.

21. Should any person refuse to make either returns or to answer any of the questions you are authorized to put, you should remind them that under Section 11 of the Act the penalty for not filling in the Schedule is £10, and under Section 14 the penalty for not answering a collector's necessary question is £10, and under Section 15 the penalty for not giving the required information as to absent persons is £10. You should also warn persons whom you may suspect of giving false information, that under Section 26 of the Act "any person who shall knowingly make in any form or document filled up or supplied in pursuance of this Act, or in answer to any question asked him under the authority of this Act, any statement that is untrue in any material particular is liable to a penalty of £50."

Should such person still persist in refusing to supply information or in supplying it untruly, you should at once report the matter to the Enumerator, so that the requisite steps may be taken to enforce compliance with the law. You should also point out that the information sought is confidential and is asked for, not out of mere curiosity, but for general use, and if necessary you should draw attention to Section 24 of the Census and Statistics Act, under which any officer who, except as allowed by this Act, divulges the contents of any form filled up in pursuance of this Act or any information furnished in pursuance of this Act, is liable to a penalty of £50.

# HOUSES "UNINHABITED" AND "BEING BUILT."

22. You should fill in a separate Householder's Card relative to each house intended for a residence which may be uninhabited or in course of erection at the date of the Census, giving the particulars required on the Householder's Card as far as it is possible for you to do so. The word "uninhabited" or "being built," as the case may be, should be written across the card. No account is to be taken of buildings such as churches, stores, &c., in which nobody sleeps, and which are not used nor intended to be used either wholly or in part as dwellings.

# CERTAIN COMPARTMENTS NOT TO BE CONSIDERED AS ROOMS.

23. Unless some one sleeps therein, shops, offices, stores, bathrooms, pantries, and outhouses, are not to be considered as "rooms." In the case of public offices, banks, stores, &c., in which a person or family resides in order to take care of the premises, only the number of rooms occupied by such person or family is to be given, and not the total number in the building.

# PERSONS CAMPING OUT ON CENSUS NIGHT TO BE DULY ENUMERATED.

24. You are required to fill in one or more Schedules with particulars respecting any travellers or persons you may find camping out or sleeping in the open on the Census night. You should also make inquiry and furnish an estimate respecting the number, sex, &c., of any such persons whom you may ascertain were in your district on that night, but whom you did not succeed in meeting, so as to insure that every person who was in your district on the night of the 2nd April, with the exception of aborigines living in the wild state, has been duly accounted for. In such cases enter in the line "Street, &c.," the word "Camper-out," "Travelling," &c., as the case may be.

# INK TO BE USED BY COLLECTORS IN MAKING ENTRIES.

25. All entries made in the Schedules by you must be made in ink.

# ERRORS TO BE STRUCK OUT, NOT ERASED.

26. In case of a correction having to be made, the incorrect information must be carefully struck out, not erased, and every alteration thus made must be initialled by you.

# COLLECTOR TO INITIAL ENVELOPE.

27. When satisfied as to the correctness of all the cards contained in an envelope, you should initial each envelope in the left-hand lower corner.

# SCHEDULES TO BE EXAMINED AND OMITTED INFORMATION SUPPLIED.

28. When you have collected the Schedules you must examine them to ascertain that all those distributed have been returned to you, and that each card is properly filled in. In case of omissions in either respect, you should, with the utmost promptness, take steps to obtain the information omitted.

# SCHEDULES TO BE ARRANGED, CERTIFIED, AND RETURNED TO ENUMERATOR.

29. The filled-in cards are to be left in their envelopes and the envelopes stacked to a convenient height in their proper numerical order so as to make a suitable parcel, each such parcel having the number of the district and the letter of the Collector's District marked on the outside. The Collector's Compilation and Record Books, duly completed, should also be enclosed, together with a declaration on Census Form 25, signed by you before a Justice of the Peace. These parcels must be delivered to the Enumerator as early as possible after all the forms have been completed and received by you.

# SURPLUS SCHEDULES TO BE RETURNED TO ENUMERATOR.

30. After the work has been completed, all surplus cards, instructions, and envelopes, and any other things used in connexion with the Census are to be forwarded to the Enumerator, together with a list of the same in duplicate, one copy of which will be duly signed by the Enumerator and returned to you as a receipt.

#### ENTRIES IN COMPILATION BOOK TO BE MADE DAILY.

31. After completing the outdoor portion of each day's work, you should, whilst the distribution is progressing, proceed during the evening to make entries in your Compilation Book, concerning the Householders' Schedules which you have distributed or collected during the day, and thus keep the compilation in a forward state so as to enable you to deliver your returns to the Enumerator as early as possible after the collection has been completed. The additional information required in the Compilation Book relative to the number of persons recorded on each Schedule should, whilst the collection is going on, be entered every evening from the Householder's Schedules collected that day.

# DISTRICT AND COLLECTOR TO BE SPECIFIED ON FRONT PAGE.

32. The distinguishing letter of your district must be stated on the first page in addition to your own name; if the Enumerator should omit to insert these particulars, you are to enter them yourself.

# SCHEDULE LOST OR DEFACED TO BE ACCOUNTED FOR.

33. The number of every Schedule must be entered consecutively in the proper column. If a Schedule should be lost or defaced at the dwelling where it was left, and another substituted, the words "Lost, Schedule No......substituted" (No. to be given) must be added after the number of the lost Schedule, and a note made of the circumstances in the column headed "Remarks," so that the missing Schedule may be accounted for

#### ABORIGINALS.

34. The only persons not legally forming part of the population of the Commonwealth are Full-blooded Aboriginals. Any such enumerated must be included in the first two columns headed "Total Number of Persons," &c., but they must subsequently be shown separately according to their sex in the following columns. Half-caste Aboriginals, Chinese, and other Asiatics, whether full or half-caste, are not to be shown separately, but care must be taken that they are distinguished as such on line 10 of the Personal Card.

# CASES OF MORE THAN ONE SCHEDULE TO A BUILDING TO BE NOTED.

35. In every case where a building is subdivided between different householders, the fact is to be recorded in the column headed "Remarks" in your Compilation Book, so as to shew the number of houses as distinguished from the number of Schedules.

# SCHEDULES AFFECTED BY REMOVALS TO BE NOTED.

36. If, owing to removals or other causes, you cannot recover certain Schedules distributed by you, you must note the circumstances opposite the numbers of such Schedules respectively. If, on the other hand, you receive Schedules distributed in other districts, you should enter them after your own and make a note that they were distributed by other collectors.

## TOTALS NOT TO BE CARRIED FORWARD TO NEXT PAGE.

37. The totals at the bottom of each page are not to be carried on to the next page, but are to be copied into the Summary Form at the end of the book. This Summary is then to be added up so as to show upon one line the required particulars respecting your whole Collector's District.

# ESTIMATE TO BE MADE OF DISTANCE TRAVELLED.

38. At the end of each day's work a careful estimate should be made of the number of miles travelled by you during the day, and the total distance travelled in the work of distributing and collecting the Schedules in your district should be inserted in the space provided for the purpose at the foot of the Summary in your Compilation Book.

# ACCOUNT OF HOUSEHOLDERS' SCHEDULES AND "CERTIFICATE OF COLLECTOR."

39. All cards, instructions, and envelopes received by you are to be duly accounted for in the form provided for that purpose at the beginning of the book. All completed cards contained in each envelope must be duly accounted for in the space provided for that purpose on the envelope. No blank cards or returned instructions should be included in the envelope together with the completed cards. The "Certificate of Collector" on the last page of the book must be signed by you before the book is returned to the Enumerator.

# CERTIFICATE OF APPOINTMENT AND INSTRUCTIONS TO BE CARRIED BY COLLECTOR.

40. You should carry your certificate of appointment and a copy of these instructions with you in case your authority to carry out the provisions of the Act should be questioned.

# CENSUS RETURNS STRICTLY CONFIDENTIAL.

41. You will remember that by Section 24 of the Census and Statistics Act 1905 all Census returns are confidential documents, and that any officer divulging their contents is liable to a penalty of £50. You are not therefore either directly or indirectly to divulge or make use of any information collected or acquired by you in connection with your duty as collector.

# STATE SUPERVISOR TO BE COMMUNICATED WITH ONLY IN CASES OF EXTREME URGENCY.

42. In a general way, and in all questions regarding your duties, you are to address your Enumerator. In urgent cases, however, as, for instance, if a further supply of Schedules should be wanted at the last moment, you may, when the Enumerator is not conveniently at hand, write or telegraph direct to your State Supervisor.

# ARRANGEMENTS WITH POSTAL AUTHORITIES.

43. Each collector shall forward all correspondence with the Enumerator or State Supervisor in envelopes supplied for that purpose. Postage stamps for these will not be required, since the postage will be paid by the Enumerator or State Supervisor on receipt.

# TELEGRAMS TO BE SENT IN URGENT CASES ONLY.

44. You will understand that, wherever possible, communications are to be made by letter in preference to telegrams, the latter being sent only in urgent cases not admitting of the delay incident on the transmission of a letter. When telegrams are sent, the matter is to be condensed into as few words as possible. All telegrams sent by a collector to the Enumerator or State Supervisor must be marked "Collect," and the collector, when sending a telegram, must produce to the telegraph officer his certificate of appointment as evidence thereof.

# HOUSEHOLDERS' SCHEDULES TO BE DISTRIBUTED ON BOARD SHIPS WHERE SUB-DISTRICT INCLUDES SHIPPING.

45. No special shipping Schedules have been printed, and in the event of your sub-district consisting either wholly or in part of shipping, you will receive from the Enumerator a sufficient number of ordinary Householders' Schedules, which should be distributed by you on or before Saturday, 1st April, to the masters or persons in charge of all vessels in port in your sub-district.

You are required, on all Householders' Cards used for shipping, to strike, out the three lines-

- (1) Nature of building;
- (2) Material of which outer walls are built;
- (3) Number of rooms;

and to substitute therefor-

- (1) Kind of vessel;
- (2) Material of which built;
- (3) Net registered tonnage.

No reply will, of course, be required to questions (4) and (5).

#### COLLECTION OF SCHEDULES ON BOARD SHIPPING.

46. On Monday, 3rd April, you will proceed to collect the Schedules previously distributed, and in the case of any vessel, which has arrived in the port on Sunday, the 2nd April, without a Census Schedule on board, you will furnish the master or person in charge with such a Schedule to be filled in.

#### ALL PERSONS ON BOARD TO BE ACCOUNTED FOR.

47. Every person who slept or abode on board during the night of Sunday, 2nd April, whether officer, member of crew, passenger, or visitor, should be accounted for on the Schedule; but no person should be included who was absent from the vessel on that night, unless such person returns on Monday, 3rd April, and has not been elsewhere accounted for.

## VESSELS ARRIVING IN PORT WITHIN A WEEK OF CENSUS NIGHT.

48. Inquiry must also be made of every vessel which arrives at the port within a week of Census night, whether its last port of call was in the Commonwealth, and if it was, whether a Census Schedule has already been supplied elsewhere. If no Schedule has been supplied, one must be duly filled in, giving the requisite particulars relative to every individual on board that vessel at the time of arrival, in the same manner as if it had been in port during Census night. In the case of a vessel arriving after sunrise on Monday, the 3rd April, from a port outside the Commonwealth, a Census Schedule will not be required.

# RECORD AND COMPILATION BOOKS TO BE USED.

49. When distributing and collecting Schedules on board ships, entries should be made in your Record and Compilation Books similar to those made in connection with Schedules distributed on land. As far as the circumstances of the case will permit, all instructions herein given apply also to Schedules distributed on board ship.

# HOUSEHOLDERS' SCHEDULES TO BE PLACED ON BOARD VESSELS LEAVING FOR OTHER COMMONWEALTH PORTS WITHIN A WEEK PREVIOUS TO CENSUS.

50. Every vessel leaving any port in your Collector's District for any other port in the Commonwealth on any date within a week prior to the 2nd April must have a supply of cards, instructions, and envelopes placed on board, so as to admit of a return being furnished without delay at the next port reached subsequent to Census night.

(Signed) G. H. KNIBBS,

Commonwealth Statistician.

Commonwealth Bureau of Census and Statistics, Melbourne, 30th September, 1910.

# APPENDIX 10.

# REPORTS OF STATE SUPERVISORS ON THE COLLECTION OF DATA FOR THE CENSUS OF 3rd APRIL, 1911.

#### I.—NEW SOUTH WALES.

Having completed the period for which I was appointed Supervisor of the Census for New South Wales, I desire to make the following remarks on some of the features of the past Census.

Neither floods nor drought interfered with the distribution and collection of the returns. The only districts affected at all were Bourke, Brewarrina, and Walgett, and no delay was occasioned, as the enumerators anticipated any possibility thereof by allowing the collectors extra time to carry out their work.

I am not aware of any special difficulties suffered by, nor were special arrangements made for the conveyance of, the collectors.

In respect of the enumeration of travellers on trains, some difficulty was experienced in making arrangements with the Chief Commissioner. My first suggestion, that guards or other railway employees should collect, was not approved, and not until the Saturday preceding the Census Day would the Commissioner suggest an alternative, and then only after very strong personal representations had been made by me as to the liability of the railway authorities to assist the Commonwealth in the work of collecting the Census on the trains. This delay on the part of the Commissioners probably contributed to the loss of some travellers on the trains. Cards were handed to each passenger travelling on Sunday night, April 2nd, with a pamphlet instructing him to hand the filled-in eards to the Station Master on arrival at his destination. Lists of travellers not receiving cards from the railway officials were received at this office from the railway authorities. Those persons were promptly communicated with, and in this way a number of travellers were enumerated who otherwise would have been missed.

Special arrangements were not made for the enumeration of shipping and vessels in ports other than Port Jackson, beyond those given in the "Instructions," but each enumerator was directed to take every precaution to avoid missing any people on board or travelling by ships.

The services of the police were not available until strong representations had been made by me as to the absolute necessity of their employment in districts where the enumerators stated it was impossible to obtain civilian collectors. Police were employed in the districts—Patrick's Plains, Nyngan and Wyalong, the last district being, with the exception of one sub-district, collected entirely by police officers. Without their assistance the enumerator at Wyalong would have fared badly. Their assistance was also given to two collectors in the City of Sydney in obtaining particulars of "Domain Dwellers" and others of the" outdoor" dwelling type. In North Sydney, Pittwater, and Manly the police assisted the collectors in obtaining particulars of "week-end campers."

Chinese Interpreters were employed in the following districts:—City of Sydney, Marrickville, Deniliquin, Hay, and Narrandera, and it was expected a Syrian Interpreter would be necessary in Broken Hill.

In the City of Sydney also a small fee was paid to a collector who had a knowledge of French and Italian, to collect particulars of a few families who did not understand the English language.

Strong representations by circular were made to each enumerator to be very careful in the collection of "migratory" people, such as rabbitters, gum-getters and others whose occupation causes them to be continually on the move.

As regards the correspondence and other papers, some of the files have not been written up, and the indexing is not done. All letters, except those from the enumerators asking for Census material, have been put into the files, but the majority of the precis sheets have not been written up. The pressure of work at a critical time caused these matters to get into arrears, which have never been overtaken. Mr. Aland is aware of all the conditions of these matters.

(Signed) JOHN B. TRIVETT,

6th October, 1911.

State Supervisor of Census, New South Wales.

# II.—VICTORIA.

Referring to your letters of 19th May and 10th June last, I have the honour to submit a report on the main features of the recent Census in this State.

In accordance with your request I beg to give information in regard to the special points detailed by you, as follows:—

# DESPATCH OF CENSUS MATERIALS TO COLLECTORS.

I am unable to state the exact dates on which the Census materials were sent to collectors, as these were issued by the enumerators. I think it probable, however, that the earliest date would be not more than three weeks prior to the Census date.

The first batch of letters of appointment to enumerators was issued from this office on 31st December, 75 letters being despatched on that date. In each letter was enclosed a copy of the form "Instructions to Enumerators," and forms of Declaration and Undertaking to be signed. On 13th January each of the enumerators who had been appointed received copies of the forms "Instructions to Collectors," "Financial Instructions," and "Census Act." The other enumerators received forms containing instructions as they were appointed.

The first materials despatched to enumerators were O.S. Postage Stamps, Envelopes, Foolscap for stamp account and Contingency Forms. On 27th January a supply of stamps was sent to each of the enumerators whose appointments had been approved, and in the same packet were enclosed the envelopes, etc., mentioned above. The packets were sent by parcel post for safety. Originally, £3 in O.S. stamps were sent to each of the country, and £2 to each of the town enumerators. Further supplies were issued as desired.

Postage Stamps.—A great deal of work was thrown on the State Supervisor and his staff, also on the enumerators, through it being necessary to stamp all letters. A great saving of time would be effected if an arrangement could be made with the Post Office, that all Census material should be carried by it without stamps being affixed thereto. I understand that this arrangement was in operation in Victoria in 1901.

Supplies of schedules, cards, etc., were sent to the outlying country districts first, the earliest issue being on 21st February to Districts Nos. 32, 38, 45, 73, and 89. The last districts to receive supplies were Nos. 24, 25, 26, and 27, the papers for which were issued on 14th March. Supplementary cards, forms, etc., were issued at the request of the enumerators. A considerable amount of correspondence with enumerators was entailed through the latter overestimating the number of cards required. The personal cards actually issued by the State Supervisor exceeded the estimated number of persons in the districts by over 30 per cent. The number asked for by enumerators was much greater.

The cards for the country districts were packed in boxes of convenient size obtained principally from dealers. The schedules of instructions, bags and other light material were in many cases enclosed in sacks. In the case of town districts, the materials were despatched by van, and an officer accompanied the carrier to see that each enumerator received the supply allotted to him. In a few instances boxes were lent to the enumerators for storage purposes and for use when returning the cards.

The bulk of the country despatch work was carried out through the agency of Messrs. Permewan, Wright and Company, through whom also most of the completed cards were returned by the enumerators. The firm of carriers which attended to the town delivery was Mayne, Nickless and Company, their van being employed by the day. With the office records of the Census are included despatch sheets shewing the number of cards, forms, etc., forwarded to each enumerator.

The district maps and Schedules A and B were sent to the enumerators at the same time. The first packets were despatched on 21st January to Districts Nos. 44, 46, 51, 63, 64, 65, 66, 69, 71, 73, 74, 88, and 89, the last on 27th February to Nos. 8, 13, 15, 16, 23, 25, 26, and 27. The proposed collectors' districts were marked on these maps by the enumerators, and the maps were then returned along with Schedule A. This schedule contained an estimate by the enumerator of the number of days required by each collector. In some instances great difficulty was experienced in obtaining the maps and schedules from the enumerators, and many hastening letters and telegrams had to be sent. The first collectors' maps were issued on 7th March to Districts Nos. 31, 39, 41, 46, 50, 59, 60, 63, 67, 68, 70, 71, 79, 82, 86, 89, and 90, the last on 25th March to No. 42.

# WEATHER.

The earlier part of 1911 was exceptionally wet in Victoria, but during the actual Census period the weather was favourable, and I have no reason to believe that the distribution and collection were interfered with by either droughts or floods. There were places which, though usually dry, were under water on account of recent heavy rains, but the enumerators were aware of these, and made the necessary arrangements beforehand. This caused an increase of cost in the districts affected.

There were, of course, many places where the collectors had to traverse very rough ground, but I know of no instance where a cellector was unable on account of the nature of the country to ride a horse. The only means of conveyance in Victoria were bicycles, horses, buggies and (in a few instances) boats.

# SPECIAL ARRANGEMENTS FOR ENUMERATION OF TRAVELLERS.

Travellers in Trains.—Enquiries were made from the Railway Department a few days before the Census date, as to what trains would be carrying passengers during the early hours of Monday morning. A list was supplied from which it appeared that there were very few of such trains. The Department used every effort to facilitate the collection by issuing instructions to its officers who might be on duty on the Census night to see that their Census cards were filled up, and by issuing an order that no passengers would be allowed to travel on the Census night except Members of Parliament, who would be specially recorded. Only three persons were returned as having travelled on the trains.

Travellers on Ships.—The shipping was divided into three portions: (1) that at the port of Melbourne, (2) that at the port of Geelong, and (3) that in Port Phillip Bay and in the various ports and inlets around the Victorian coast. Persons living in certain lighthouses were included in the third portion.

The great bulk of persons on ships were included in the first section. As practically the whole of the shipping at the port of Melbourne is under the jurisdiction of the Melbourne Harbour Trust, the work of enumeration was entrusted to that body, the Harbour Master (Captain Vincent) being in charge. He utilised the services of employees of the Harbour Trust as collectors, and there is every reason to believe that the work was efficiently carried out. Some of the collectors did the work on foot, others used boats belonging to the Harbour Trust. No charge was made for the boats, but an allowance was made to the boatmen. The enumerator received a fee of £10 10s., and the collectors received payment according to the time occupied, the basis of calculation being 10s. per day.

At the port of Geelong there was very little shipping, and the work was carried out under the supervision of the enumerator for the district of Geelong, his collectors including in their ordinary duties the collection from the ships.

The collection in Port Phillip Bay (outside the port of Melbourne), and in vessels in other ports and inlets around the coast was attended to by Mr. Maclean, Engineer of Ports and Harbours for Victoria, who received a fee of £10 10s. The work was carried out by the employees of his branch, who, except in a few special cases, received no payment.

Shipping on the Murray and other rivers was attended to by the enumerators of the adjoining districts.

The collection of the shipping presented no special difficulties, chiefly on account of the zeal shewn by Captain Vincent and Mr. Maclean, and to the fact that each of these enumerators had a well-organised staff to assist him. Both of these officers appeared to be quite satisfied with the remuneration paid to enumerators and collectors. Every care was taken to see that the instructions issued by the Commonwealth Statistician in regard to shipping were complied with.

#### POLICE.

The police were not used as ordinary collectors, but they rendered assistance in other ways.

Shortly before the Census date—on 7th March—enumerators in the metropolis and large towns were asked to state whether they desired the services of the police for purpose of protection in parks and other camping grounds in their districts. Lists of gardens and other resorts of the migratory class were furnished by the enumerators, and were sent to the Chief Commissioner of Police, who deputed constables to attend the collectors engaged in the special duty of searching those places on Census night.

Immediately before the Census date the Commissioner of Police was asked to issue instructions to the police to make enquiries from vagrants, campers, and any other persons having no fixed place of abode whom they might meet as to whether they had filled up a Census card. If they had not, their names and approximate ages were to be taken and forwarded to the State Supervisor, and they were to be referred to the nearest post office for cards. As the result of this instruction about 100 names were received from the police.

The police were also asked to report any case which might come under their notice where persons had not received Census cards.

In a few instances reports reached this office of a number of persons having been omitted. Instructions were at once issued by me to the enumerators that the omissions must be rectified. The publicity which was given to any defects of this nature leads me to believe that only in isolated instances would it have been possible for persons to be omitted without the Department becoming aware of it.

#### INTERPRETERS.

The following interpreters were employed:—Melbourne and Suburbs—6 Chinese, 1 Indian, 1 Russian. Other towns and country districts—10 Chinese.

This matter gave rise to a considerable amount of trouble, chiefly on account of the difficulty experienced in obtaining particulars regarding Chinese. The bulk of these are located in Melbourne East, the enumerator for which district was Mr. E. H. Clarke. As there was some difficulty in getting reliable interpreters, I availed myself of a suggestion made by Mr. Clarke, that he should be asked by enumerators to obtain suitable men for Melbourne and Suburbs. Three interpreters were employed in Melbourne East, and one in Brighton and Malvern, one undertook the collection of the Chinese in the three Districts of Brunswick, Essendon and Coburg, and Moonee Ponds and Flemington, and one acted as interpreter for any portion of Melbourne or Suburbs for which he might be wanted. The chief difficulty in the outlying districts was that the collectors did not know beforehand what Chinese there might be in their sub-districts, and in consequence of this no arrangement could be made in anticipation. To get over this difficulty the metropolitan enumerators were instructed to supply Mr. Clarke with the names and addresses of any Chinese they might find in their districts for whom an interpreter was wanted, and that gentleman undertook to supply an interpreter for all these scattered cases. I am of opinion that by this means everything possible was done to secure an accurate enumeration of the Chinese.

In isolated country districts the Chinese can usually speak English, and can be relied on to give correct information. In the event of difficulty arising, collectors were instructed to obtain as accurate information as possible from inquiry and observation.

Chinese interpreters in the metropolis were paid £1 ls. per day, in some of the country districts the remuneration was only 10s. 6d. per day. The Russian and Indian interpreters had very little work to do, and received only 10s. 6d. each. As it was impossible to gauge the amount of work beforehand, it appeared that the only course that could be adopted consistently with the obtaining of accurate information was to pay a fixed sum for each day occupied. An endeavour was made to keep a check on the time of the interpreters in the metropolitan area, but it was explained that great difficulty was experienced in obtaining the requisite particulars from the Chinese, and frequent calls had to be made at the same address. The collectors were required to certify to the time occupied by these interpreters. Collectors accompanying interpreters received similar remuneration to those employed in other sub-districts.

# VESSELS IN PORT.

See above, under heading "Travellers on Ships."

# DISTRIBUTION AND COLLECTION.

The range of time taken by the various collectors is shewn in the Collectors' Record Books. Owing to the varying sizes of the districts and the special difficulties encountered in many of them, a statement of the longest and shortest periods will not give much indication of the average time required.

The first complete return was received on the Tuesday afternoon from a metropolitan collector. The sub-district had a population of about 1200 persons, and the time occupied was about a week. The longest period reported to me was 26 days in the case of a collector in one of the Mallee districts. I should say that most of the town collectors took from 6 to 9 days. In the country the time varied considerably, but in the more settled districts it was rarely less than 5 or more than 12 days. In the outlying districts a period of from 13 to 18 days appears to have been taken in a number of cases. Speaking generally the time occupied seems to have been from a week to a month. This does not take account of a few cases where the collectors' districts were below the average in size, or of the time occupied by collectors in dealing with queries submitted to them after the ordinary work of collection had been finished.

The first complete return of population for a district was received from the enumerators of Districts Nos. 46 and 75 on 10th April. There were 95 districts, and the following statement shows the number of complete returns which had been received by various dates:—Monday, 10th April, 2 returns; Monday, 17th April, 15 returns; Monday, 24th April, 37 returns; Monday, 1st May, 56 returns; Monday, 8th May, 71 returns; Monday, 15th May, 80 returns; Monday, 22nd May, 85 returns; Wednesday, 31st May, 92 returns; Tuesday, 13th June, 94 returns; Monday, 3rd July, 95 returns.

It was not necessary to delay the publication of the population results for the State until the last three returns were received, as a close approximation to the populations of those districts had been received before the complete returns were available. An estimate of the population of the whole State was sent to the Commonwealth Statistician on 27th May.

The first districts from which completed cards were received were Nos. 10, 15 and 46. The dates of receipt of the completed cards are shewn in the next statement:—Wednesday, 12th April, 3; Monday, 24th April, 14; Monday, 1st May, 37; Monday, 15th May, 73; Wednesday, 31st May, 86; Thursday, 13th July, 95.

The degree of care exercised in the examination of the completed cards varied considerably with different enumerators, and it is probable that the delay which occurred in forwarding these cards in certain cases was due to the pains taken by enumerators to ensure compliance with instructions.

# GENERAL REMARKS.

The experience which I have gained as the result of my connexion with the Census work leads me to offer certain suggestions.

Districts.—One of the most important points to be decided at the commencement of the work is the mode of division of the States into enumerators' districts. In Victoria the districts adopted at the recent Census corresponded (except in a few cases) with the Census and State Electoral Districts of 1901. By this means the trouble of remodelling the districts was avoided, but there was the objection that owing to changes having taken place since 1901, the Census districts of 1911 did not usually correspond with any recognised divisions—Municipality, Federal or State Electorate, etc. An examination of the boundaries, however, shewed that great care had been exercised when they were originally fixed. Wherever possible these were represented by natural features such as mountains, rivers, &c. In Victoria there were 93 enumerators' districts, apart from the two relating to shipping, a larger number, I believe, than in any of the other States. The larger the number of districts the greater the amount of work involved in correspondence and supervision, and if one could rely upon getting competent enumerators at short notice, I would certainly recommend a material reduction in the number, say to 50. An advantage of such reduction would be that the enumerators could be offered a larger remuneration, and there would be less difficulty in obtaining good men than at present. On the other hand, if any hitch occurred in the arrangements shortly before the Census date, there would be greater difficulty in obtaining a substitute for an enumerator than if the district were a small one. The work thrown on the draughtsmen would be reduced in the event of the system of large districts being adopted.

If it were considered advisable to have small districts, the most suitable division would be according to municipalities, which, for convenience, may be called the municipal method. This method has various advantages. The districts would be clearly defined, and the population records for municipalities would be obtained without any trouble. My experience has led me to believe that municipal officials are generally the best enumerators obtainable. They must possess certain educational qualifications before receiving their positions, and the nature of their work is more akin to Census work than that of persons engaged in business such as auctioneers and estate agents or commission agents. As a rule electoral inspectors are also good enumerators. Persons engaged in business in a small way may not be of sufficient standing to enable them to obtain collectors of a good class, while those with a large business usually have expensive ideas, and are apt to leave the work to subordinates. This course is unsatisfactory, as the nature of the work is such that the enumerator must devote to it a great deal of personal attention. Municipal and electoral officers are accustomed to details, and are likely to give more attention to them, and to follow more closely the instructions received, than persons in other occupations. They are also well acquainted with their districts.

A distinct advantage of the municipal method of division is that there would be little difficulty in regard to the appointment of enumerators. The Town Clerk or Shire Secretary or some other municipal officer would be expected to act in every instance unless he had an unsatisfactory record. In such cases it might be possible to employ an electoral officer. When the appointments of enumerators were made for the recent Census there were many complaints from disappointed applicants. There would be no excuse for such complaints if it were known that the municipal officer received the appointment by virtue of his official position.

There are 208 municipalities in Victoria. If there were 208 instead of 93 Census districts, the work devolving on the Supervisor and his staff and on the draughtsmen would be greatly increased, and the cost of supervision would consequently be greater.

After considering the relative advantages of the two methods—the division of the State into large districts and the municipal method—I am of opinion that the latter, though more costly than the other, is the safer and more convenient one. Under this method the enumerators should have less difficulty in getting collectors, and it should be possible to obtain results from them more promptly than when the districts are large. The close supervision of collectors by enumerators would also be facilitated.

In the recent Census the staff of the State Supervisor consisted of a records clerk, a typist, and three ordinary clerks, also, during three or four months, a senior clerk and a typist working in the evenings. The records clerk was really Assistant Supervisor, as he had the supervision of all details. The pressure of work was so great during the two months preceding and the month following the Census, that it was only by working till a very late hour each day that the skilled officers were able to cope with it.

If the system of making the Census districts correspond with municipalities be adopted, I would suggest that an Assistant Supervisor be appointed from six to nine months before the Census is taken, the exact date of his commencing duty to depend on the amount of preliminary work to be performed, also that a senior clerk be engaged before the issue of the enumerators' appointments, say four months before the Census date. One advantage of having two such officers instead of one is that in case of need it would be possible to send one of them to any part of the country in which a difficulty might arise, which could not be dealt with satisfactorily by correspondence. There were several occasions during the recent Census when there was reason to fear a serious hitch, and a personal call would have relieved the tension at once. Of course, strict economy would have to be exercised in incurring travelling expenses of this nature, but there is every likelihood that such expenses would be more than compensated by reduction in the cost of collection.

For the Assistant Supervisor a suitable remuneration would probably be 15s., and for the senior clerk 12s. a day. It might be necessary within three months of the Census date to appoint in addition to these two officers a second experienced clerk at 12s. per day. Two typists would be required, one to be appointed at the same time as the first senior clerk referred to, i.e., about four months before the Census date, and the other a month or two later. There would also be ordinary clerks to prepare the material for despatch, and to do the routine work.

If the work is to proceed smoothly during the critical months—about two months before, and one after the Census—it is necessary to have a sufficient amount of skilled assistance, and the skilled officers must have been engaged so long beforehand that they have become thoroughly accustomed to their duties.

If it were decided to have large districts it would be necessary to invite applications from persons suitable for the position of enumerator and to make inquiries in regard to such persons. If the boundaries of districts had been tentatively fixed, the State Supervisor might find it desirable to recommend alterations so as to meet the wishes of enumerators. These and other matters of a preparatory nature would occupy a good deal of time, and under the "large districts" system, therefore, it would be desirable that the Assistant Supervisor should be appointed at least nine months before the Census date. Under the "municipal system" the appointment might be made a month or two later, as the preparatory work would be much less. The boundaries of districts would not be subject to material alteration, but it would be necessary to make inquiries regarding municipal officers, and in some cases to invite applications from outsiders. The Assistant Supervisor would have to make himself familiar with the methods previously employed, as well as with the official instructions in regard to the current Census. He would also need to familiarise himself with all details, so as to be in a position to instruct the enumerators and the staff in regard to their duties at a later date.

Remuneration of Enumerators.—Under the "municipal system" the districts would be much smaller than at present, and the remuneration to individual enumerators would be less. It is probable, however, that there would be an increase in the total remuneration.

Remuneration of Collectors.—This matter gave rise to probably more difficulty than any other during the recent Census. The position had altered in certain aspects since 1901. On that occasion schedules were used, while in 1911 the collection was made through the medium of cards. Also, there was an industrial depression in 1901, while ten years later there was a brisk demand for labour. The remuneration fixed for collectors at the later date was, I think, in the majority of cases more than the equivalent of that paid in 1901. There was, however, more difficulty in obtaining collectors, and there was a tendency on the part of those employed to institute comparisons with the wages paid in occupations for which a special training was required.

The greatest difficulty was with the collectors who performed the work on foot and received remuneration at the rate of 10s. per day. It was first assumed that for a full town district of 200 houses 5 days would be required, the remuneration being £2 10s. + 5s. When extra payments were subsequently granted, a minimum of 6 days was allowed for these districts.

One method of reducing the difficulty in regard to payments to collectors which has arisen at recent Censuses would be to increase the scale of payment to those on foot. In many cases they had to make calls in the evening as well as during the day, and it was necessary therefore that they should work for more than the usual hours. This is unavoidable, as the householders are often absent during the day, and do not trouble to prepare cards until they see the collector. For this reason it might be well to consider the advisability of making the scale of payment 12s. instead of 10s. per day. By increasing the rate of payment it would, I think, be possible to obtain a better class of men than at the recent Census. Collectors might also be allowed 8s. for making up their books, as the work would usually occupy the time of the average town collector for a full day. It would take less time in many of the country districts, but it would probably be found injudicious to make a distinction.

Of course, the rate of payment would depend largely on the wages ruling at the date of the Census.

I would not suggest any increase in the size of the collectors' districts. Such increase would lead to delay in the completion of the work, and unless the collectors were very competent it would interfere with the efficiency of the work.

A statement relating to expenditure has been prepared, and is being submitted separately. This shows the remunerations of the enumerators, their travelling and other expenses, and the payments to collectors, also the amount spent in postage by the State Supervisor and the enumerators, the petty cash expenditure, and the other disbursements made by the State Supervisor, such as cost of collectors' bags, rubber stamps, and stationery, cost of transmitting Census material to enumerators, etc. It has not been possible to prepare a complete statement owing to the fact that, in addition to the paying of accounts certified by me, the Accounts Branch of the Home Affairs Department made a number of payments of which I have no official knowledge. I have, moreover, reason to believe that some of the accounts which I had certified were altered, so as to conform with the practice of the Department, without advice being sent me.

Police.—The police were not employed as collectors in Victoria, but except in one or two remote districts I do not think any inconvenience was caused by this. I doubt, moreover, whether the police would be satisfactory as Census collectors. I have had considerable experience of them as collectors of agricultural and other statistics, and my opinion is that while the work would be done with great care, it would occupy much too long a time. In some cases enumerators and collectors made enquiries from the police as to the time that should be allowed to collectors. The periods mentioned by them were much in excess of what were considered reasonable by me.

There is the further difficulty that there might be urgent public need for the services of these officers for the detection of crime during the Census week. If the Australian Census were taken over an extended period as in the United States, and not at a fixed date, the police might be very suitable, but under present conditions I do not think they would do the work as efficiently as ordinary citizens.

Hotels.—A weak point in the recent Census collection was, in my opinion, the manner of dealing with large hotels. A number of cards were left at the hotel a few days before the Census date, and the collector called shortly after that date for the completed cards. It rested with the proprietor to take steps to obtain the information from each resident of the house. If he omitted to do so there was often no means of getting it afterwards. At the next Census it might be advisable to adopt more stringent means than hitherto to ensure that hotelkeepers are not to allow persons living in the house on Census night to depart without obtaining from them the required particulars.

Interpreters.—The general plan adopted in regard to interpreters was found to be satisfactory, and I would suggest its continuance. Where there are many foreigners living in one district special interpreters will be required; in the case of the suburban districts of Melbourne, where there are few foreigners, and these are at considerable distances from each other, a special interpreter should be sent from headquarters at a time arranged beforehand; in remote country districts the collectors should obtain as accurate information as possible by inquiry and observation. The great difficulty in dealing with Chinese is there may be collusion between the interpreter and the persons of his race with a view to prolonging the work. One may suspect this, but it is very difficult to get proof.

Collectors' Agreements.—Unless there is a legal difficulty, I would suggest that collectors should in the agreements undertake to carry out their duties, including the making-up of the return, for a remuneration specified therein. If possible, the maps for collectors should be ready long enough before the Census date to enable them to have an opportunity of examining these before undertaking the work, and of thus getting exact information in regard to the extent of the duties which it is proposed to allot them.

The work of collection was greatly increased as compared with 1901, through the introduction of the card system. The principal increases in the State Supervisors' office occurred in the despatch work, and the correspondence. The official instructions issued by the Commonwealth Statistician gave full information as to the general procedure to be followed, but there were numerous matters of detail in regard to which it was found necessary to instruct enumerators from time to time. This was done principally by means of circulars, of which a large number were issued. Copies of these have been placed with the Census papers. The fixing of the periods to be allowed to the collectors in each district proved an arduous task, and it occupied much of my time during the two months immediately preceding the Census. There was considerable doubt as to what extra work would be entailed by the use of cards. The experience which has now been gained should be of great use at the next Census in connexion with this portion of the work. I would suggest that the instructions in regard to travelling expenses be given in more detail when the Financial Instructions are next being prepared. At the time most of the journeys were undertaken in connexion with the recent Census, it was not known that the exact times of departure and arrival had to be stated in the accounts, also, it was not clearly shown in the Instructions what would be allowed when the enumerator used his own vehicle.

In conclusion, I would like to say that I consider the Victorian enumerators were, with a few exceptions, very suitable men for the work that they had to perform. My duties did not include a careful scrutiny of the returns received from collectors, and I am unable to express an opinion, therefore, as to the degree of care exercised by the enumerators in the checking of these.

(Signed) A. M. LAUGHTON,

State Supervisor of Census, Victoria.

14th March, 1912.

#### III.—QUEENSLAND.

As requested in your letters of 19th May and 10th June, I have the honour to submit a few remarks on the subject of the recent enumeration. As the most convenient method to adopt I propose to deal with the Act, Regulations and Forms seriatim, making such comments on each as experience dictates.

Act.—Much too vague and indefinite. One great blot: No offence to refuse to take cards or schedule, or to block and annoy collector in distributing. A few prompt prosecutions for this early in the work would greatly have facilitated enumeration. Essential that enumerator should have power to prosecute on his own initiative. Collector should also be able to prosecute with approval of enumerator. It is not always possible for an enumerator to be present at the site of offence to conduct prosecution. A collector, much less an enumerator, is, on an average, a superior class of man to an average policeman, and yet the latter has full powers of prosecution in a large number of offences. Any other conditions absurd for a country so extensive as Queensland. Citizens should be compelled to state where they were on Census night. A number gave much trouble refusing to do so, stating they had been returned, but not where, and no doubt some escaped enumeration in consequence. In many instances, without assistance of detectives, impossible to prove, and even with them difficult.

# SUPERVISOR'S INSTRUCTIONS.

General.—These, as all the regulations, were evidently drafted from standpoint of settled country and then modified slightly but not sufficiently. This quite unsuited for much of Queensland.

Clause 4.—Method adopted for fixing payment most unfair both to Supervisor and enumerator, several incongruities have arisen in this State. Although payment by results would perhaps be open to objection for collectors, I consider it the only proper method for enumerators. The old State system is much to be perferred.

The words "Retaining Fee" used here and elsewhere most misleading and untrue, and when compared with the practice adopted caused much heartburning, as in many instances enumerators have been out of pocket for months, having to pay for clerical assistance.

Clause 24.—Expense of posters might have been saved as far as Queensland was concerned. They were received so late as only to be of very limited use. Practically all were destroyed.

Clause 28.—Either Supervisor's Certificate unnecessary, or enumerators should be paid on it.

Clause 29 (b).—Enumerators should have a petty cash provision. Many advanced up to several pounds for freights, and then had to wait months for reimbursement. Why should public officers finance the Commonwealth? Supposing many, as some did, declined to do so, serious failure might have resulted, as my cash credit would have been quite inadequate to meet many such demands. I certainly should not have advanced out of my own pocket, and as to wiring Melbourne???

## FINANCIAL INSTRUCTIONS (A).

Clause 1.—£1 limit absurd and an insult, and £25 cash credit equally so. Junior audit inspectors here, not much more than lads, have a £50 advance. At least £250 should be allowed.

Clause 3, Paragraph 2.—If Supervisors not to be trusted to this extent, unfit for position.

Paragraph 4.—Should be left to Supervisor.

Clause 4, Paragraph 2.—In practice this was modified, as it well needed to be.

# B.—ENUMERATORS.

Clause 1.—" Retaining Fee." This not being carried out caused much dissatisfaction, and has been a point made by Kellett in his "Statement of Claim."

Clause 2.—Exact requirements of the Treasury as to the filling of vouchers, such as the hour of arrival and departure, &c., &c., should have been clearly, fully, and definitely explained. I prophesy the effect will be felt at the next Census. Temporary Commonwealth employees cannot be expected to know all the redtape demands of Headquarters, and in a State so distant from Melbourne, the consequent delay following the rejection of vouchers for trivial omissions caused much irritation.

Clause 4, Paragraph 3.—Books were not provided as promised.

# C .- COLLECTORS' FINANCIAL INSTRUCTIONS.

Clause 1.—Insert after "obtain from each collector engaged by him" the words: "on the blank form provided for the purpose."

#### ENUMERATORS' INSTRUCTIONS.

- Clause 1, Lines 5 and 6.—No provision made for formal notification to enumerators of their appointment. Each Personal Card, &c., absurd waste. No good to children. For private house one each, 5 cards ample. More for hotels, &c.
- Clause 2.—Printing this caused much trouble, and in two cases nearly led to serious upset of Census. Enumerators relied on getting police until almost too late to obtain a private collector.
- B—Clause 3.—Much trouble was given by method adopted in preparing collectors' maps. The fact that no outside features were shewn, and the scale at times being totally inadequate, and not always the best procurable, was taken much exception to by both enumerators and collectors. It will be fortunate if as a consequence no undetected over-lapping or omitting proves to have occurred. In several instances it took place, and trouble unnecessarily was given in correcting it. I believe a little more spent in mapping would have been well worth the money.
- Clause 4.—All forms should have been specified and provided at the outset to enable the enumerator to see what he would have to do. The method adopted was most unfair, and much exception has since been taken. If the enumerators were now asked to re-engage, I think many of them, and these of the best type, would promptly refuse.
- Clause 5.—Illustrates the difficulty and practically the impossibility of satisfactorily drawing one set of regulations to properly cover an enormous country like Australia. No end of confusion and trouble was caused by the inclusion of terms unknown to Queensland.
- Clause 6.—The departure from the first intention to supply maps in duplicate caused much delay, enumerators, being without a map whilst collectors' maps were in preparation, were unable to proceed with the appointment of collectors. Not only did this in some instances imperil the securing of men, but no doubt by delaying matters prevented the making of best bargains, as time being then too short to negotiate, men had to be taken on their own terms. I should in some instances have refused approval to the time asked for only I dare not, as we were then too near Census day.
- Clause 11.—Designed for a populous centre, ridiculous for all the rural parts of this State. In country districts payment must count from leaving home and returning. It has had to be done, and in the way it was done, has proved more costly than if the bargain were left to Supervisor to carry out.
  - Clause 12 .-- Should define what to do when alphabet is exhausted, so as to secure uniformity of practice.
- Clauses 16 and 17.—The provisions here made for shipping and island population might be extended to embrace all or most outlying groups such as lighthouses, lightships (which are hardly ships), and even very outlying stations. The system of appointing one resident a special collector to send in schedules by mail or other usual route works well, and might be extended. To send a collector to one station for a journey of 200 to 300 miles twice at a cost of anything up to £50 or more, just to collect one or two schedules, is extravagant on the face of it. To my mind their count had better be lost, if a special collector system is objected to.
- Clause 18.—Special instructions should be printed for the collector, who should have more power to compel attention. Much trouble was given in some instances, and I am satisfied that leakage occurred here.
- Clause 20.—In a country so vast as Queensland the ascertaining of the population of divisions of shires as well as wards of municipalities most necessary. Some of these have the proportions of a Principality.
  - Clause 21.—Impossible to supply Schedules "A" in duplicate, supply being insufficient for the purpose.
- The term Mesh caused much confusion amongst both enumerators and collectors. Some explanation of the term and why these subdivisions are required, that collectors may see the reason for the extra trouble involved, otherwise they comply grudgingly.
- Clause 22, Line 2.—" Definite" is not a good term. Has been taken exception to by several enumerators as impossible. Perhaps due in part to a misconception of the meaning of the word. Many people look at it as implying accuracy.
- **C—Clause 25.**—If selection of collectors left till then many districts would have been unprovided for. Indeed, as stated elsewhere, great risk was run, and the best men not secured, because enumerators were without maps whilst collectors' maps in preparation, their own not being supplied in duplicate.
  - Clause 26.—Gave much trouble; received lots of applications for these
- Clause 30.—Often impossible to carry out. Where an absentee imperatively employed, travelling should be directly provided for. It has to be done, and when indirectly, much more costly. In my own case for West Moreton we broke up the Rosewood Ring by employing Ipswich men. Saved much money. The Ipswich men had to be paid for travelling indirectly.
  - Clause 32.—No provision for motor bicycle, but there was for petrol.
- Cause 33.—This and Form 27 contain between them one of the most serious of all the errors through which a large saving that might have been effected was rendered impossible.
- Clause 43.—Excise ink bottles must be provided in all rural districts at least, or else pencil will be much employed.
- D.—Clause 44.—The additional amount of clerical work involved by the employment of cards instead of schedules is so great that I am sure much more would have to be paid, both to the enumerators and collectors, if this had been as fully realised as it has since become. Of course, if the Commonwealth is prepared to "take men down" when they agree to do the work for less than it is worth, and not to pay extra claims though just, why, then, well and good, but they will have to put up with odium and be worried on account of it otherwise.

Clause 57.—I am satisfied that much more economical results would be secured by giving the Supervisor power to pay by time reasonably taken as shewn by diary, and with advice of enumerators. When collectors knew they were to be bound down they fixed the days at long enough in many cases to cover all contingencies, and where this was not done, extra claims have been made, and if not met in some instances a great injustice will be done. So the Commonwealth pays in both ways.

Clause 58.—Copy promised not furnished, would have been worth the printing to have the record kept uniformly.

#### COLLECTORS' INSTRUCTIONS.

Clause 3.—One instruction for each personal card too many, (See remarks Clause 1, Instructions to Enumerators.)

Clause 4.—Features surrounding district should be shewn.

Clause 6.—Consider carefully the clerical work involved in all this. Only collectors and enumerators, or those who have themselves sat down and written say at least 100 cards against time, can properly realise the work involved in dealing with 400 or 500 full schedules averaging 6 cards and an envelope to each. All evidence goes to shew, moreover, that a much larger proportion of cards have to be filled in by the collectors, as compared with the old schedules.

Clause 25.—I would add the words "Indelible lead pencils must not be used under any circumstances, as the writing smears and becomes illegible." Whilst it is desirable to require ink to be used, circumstances may arise, particularly in the bush, where it is not possible to insist on its use. Cards or records written with "Indelible" pencil would be nearly valueless. I speak from experience, and yet this class of pencil would be picked by many as being nearer to ink than the ordinary lead. I had many suggestions to use them, but I absolutely prohibited it for reasons given.

Clauses 31 and 37.—Some reference as to keeping figures for meshes separate should be inserted.

Census Form No. 27.—Should have agreed with the Regulations. There was much money lost from this difference.

Instructions to Public.—Too verbose. Few took the trouble to read them, and to the mass of the people they were unintelligible. If thought necessary in present form, it would be well to commence with a precis in black letter, setting out briefly say five or six of the chief points. Collectors stated that people on many occasions left the cards to be filled in by them, because they were confused by the voluminous instructions.

Cards.—I rather wonder whether the cards will be found suitable to sort without a lot of re-writing. I consider that they may suit for collection in towns, but have grave doubts as to rural districts. I am sure that from the facility with which they may be lost, and from the impossibility of tracing each card issued, as was done with the old schedules, that the collection was, on this occasion, less complete than formerly. I do not mean that any large population was missed, but that the leakage was somewhat greater. No Census is ever complete, of course. Another inherent defect leading to the same end, and causing increased work to collectors, was the impossibility of gauging how many cards (Personal) to leave at a house. As it was, we printed nearly 1,000,000, or 40 per cent. of waste, and these were really insufficient, as it was often found impracticable to have a card just where it was wanted, and there were innumerable instances in which collectors had to hunt all over the place for casual visitors only recorded on the Householder's Card, and for whom no personal card was forthcoming. On collecting, the householder said: "We had no card." It never seemed to strike any of them to fill in a card for the stranger, and to leave one of their own people to be supplied on the return of the collector. It was always the visitor who was omitted, and he had to be searched for.

As to difficulties with the public interpretation placed on designation attached to each line, you will, in the process of tabulation, become fully seized, but as regards three lines I would take exception to your rendering of them in your letter to me of 14th November, 1910, paragraph 3, Previous Marriages. If children of widower to go on 6a, is line 5 to be left blank? Otherwise you have an inconsistency between treatment of lines 5 and 6. How, moreover, would you treat line 6 in a case of person twice widowed with children by both marriages?

In conclusion, I have thought it well to obtain reports from four enumerators of districts typical of the great industries or conditions of the State, as follows:—Mr. Beak, Brisbane North (Urban); Mr. Bryce, Caboolture (Agricultural); Mr. Schulte, Springsure (Pastoral); Mr. Lee-Bryce, Herberton (Mineral). With regard to Mr. Bryce I would add that he is an enumerator of exceptional experience, having acted in that capacity in 1876 and for every subsequent Census.

(Signed) THORNHILL WEEDON,

State Census Supervisor, Queensland,

# IV .-- SOUTH AUSTRALIA.

# PART I.

South Australia proper is divided into forty-seven counties, which in turn are, with few exceptions, divided again into hundreds, numbering in all 437. For Local Government purposes all the country within counties, with the exception of the areas devoted to pastoral purposes, is divided into 32 corporate towns (three being cities) and 146 district councils. The total area of the counties is 82,103 square miles.

The detail work of mapping out the vast area of South Australia proper and the Northern Territory into suitable Census districts was commenced early in June, 1910, and the boundaries completed and submitted to the Commonwealth Statistician on the 3rd August, 1910. No previous Census in this State having been undertaken with the aid of enumerators, this work of division was absolutely new, and involved an immense amount of original and expert research to secure the most satisfactory results. It is pleasing to reflect that when put to the test under actual working conditions, adjustments were found necessary in only two or three of the 45 divisions.

It might be mentioned that every care was exercised in making these divisions to avoid dissecting the boundaries of Electoral Divisions, both Commonwealth and State, and also the boundaries of the various Local Government areas. Thus in mapping out the Census Districts all these boundaries were so effectually taken into consideration that in only a few minor instances has a district crossed one of the boundary lines, thus materially reducing the number of Mesh Districts.

#### SELECTION OF ENUMERATORS.

All other qualifications being equal, in my opinion Town Clerks and Clerks of District Councils, whose location in the district is sufficiently central, are the best persons for the Census work, whether as enumerator or collector. Some splendid men had to be passed over owing to their location in the district not being suitable for exercising a proper supervision of the whole area. The local knowledge, possessed by these officers, of the people and boundaries of the districts, is of immense value to them in Census work.

After an exhaustive enquiry as to the capabilities of all likely applicants, those who were considered likely to give good results were communicated with, and eventually a selection made. I was impressed with the importance of making no avoidable mistake in this selection, for if a Census is taken by the aid of enumerators the most capable men must be obtained, otherwise much additional anxiety and detailed supervision would be added to the work of the central office. To this end the fees should be calculated on a liberal basis.

In several districts outside business men were appointed. Many of the gentlemen selected performed their arduous duties in a very able manner, and with none of them have I been disappointed. During the progress of the work several were released from their duties from various causes, and substitutes appointed.

The vast area of sparsely-populated country encroaching upon the more populous centres will always present a difficulty in securing enumerators thoroughly acquainted with the whole area of a district.

#### VALUATION OF ENUMERATORS' DISTRICTS.

In the absence of any previous experience in this State with Census enumerators, and any definite instructions upon which to base the valuations of the work to be done by them, it was a matter of some difficulty to decide upon equitable fees and fix the same with confidence of having dealt with fairness both to the men and the Government.

While I succeeded in securing the necessary number of gentlemen for the position, on the terms approved, I have to report that a number of them have expressed themselves as dissatisfied with the fee allotted.

There is no doubt that the detailed duties prescribed in the instructions involved work of such great magnitude as is only possible of realisation by those who have actually attempted to faithfully carry them out.

From a review of the enumerators' fees on the completion of the work, I am, however, satisfied that generally speaking (with the exception of several districts), the valuations made were fairly reasonable, though by no means excessive. In valuing again I should be disposed to increase most of the districts by 10 per cent., and about three of the outlying ones, which proved fairly difficult, by about 30 per cent. I trust that some concession on these lines may be approved as regards this undertaking. A representation on this matter has already been made. The City of Adelaide was made one district, and supervised by an officer intimately acquainted with the work. Had it not been for his appointment it would have been absolutely necessary to subdivide the City into two districts of at least £50 each.

# SUBDIVISION OF CENSUS DISTRICTS.

Before the enumerators began the work of subdividing their districts, they were furnished with all available information as to the boundaries of collectors' districts at the previous Census, and many of them also called at the Central Office for personal instruction as to the duties required. Those at a distance were fully instructed by letter, and thus a fairly uniform method of procedure was secured in all districts. In some cases the boundaries were only settled after lengthy personal interviews. Men who had had experience as collectors for the 1901 Census, and given satisfaction, and district clerks were engaged as collectors where available.

#### PRINTING AND DESPATCH OF PAPERS.

The printing of the necessary supply of Census cards and envelopes was undertaken by the State Printing Department, and the orders completed expeditiously. The first consignment of parcels left the Census Office on 9th January, and the last on the 22nd February; the outlying districts with an irregular mail service were first attended to, and the districts nearer the metropolis last.

The boxes containing the papers were all packed at the Government Printing Office, under the direction of a Census clerk.

I advised every enumerator to stamp all the cards, so far as possible, before despatching them to the collectors. For this purpose I designed a rubber stamp for each enumerator, with interchangeable headings, so that it could be adjusted for each district. These were made in the city by one manufacturer and despatched with the parcels of Census material. A gauge box was also made to secure uniformity in stamping.

# THE HEADQUARTERS STAFF.

A large room attached to the Statistical Department was secured and fitted up for the Census without cost to the Commonwealth, and in the general supervision of the whole Census campaign, I was assisted by the Chief Clerk of the State Statistical Office, who also personally mapped out all the enumerators' districts. From July to December, 1910, the Record Clerk was the only clerk on the Census pay-sheet, though both he and my Chief Clerk worked a considerable amount of overtime to meet the occasional rushes of work.

As the time for despatch of parcels arrived, the staff was increased to a total of three clerks, and eventually to four when the papers were being returned.

Two additional rooms were obtained in another building on a ground floor as a receiving centre for Census papers. Two clerks were located there, and they checked all the papers on receipt, and repacked them for transmission to the Commonwealth Bureau.

#### PRELIMINARY COUNT.

The last of the preliminary counts was received on 8th June, 1911, the total preliminary count for the whole State being: Males, 208,822; Females, 202,339; Total, 411,161.

#### TRANSMISSION OF FORMS.

As the boxes from completed districts were received, the contents were examined. The cards were not individually scrutinised, but the collectors' books were examined, and the totals checked, and where irregularities appeared, the cards were examined and queried back to the enumerator where necessary. The parcels for each sub-district of a Census District were examined and uniformly labelled and repacked in accordance with Clause 27 of Form No. 8. The first consignment of cases was despatched on the 15th May, 1911, and the final consignment on 25th July, 1911.

#### UNINHABITED HOUSES.

There were many houses described as "Uninhabited" which, without explanation, might cause a wrong impression. As a matter of fact there are not enough houses for the people as strongly indicated by the large number of tenements—several families occupying the same house. In nearly all cases the houses were inhabited again within a day or two of Census night. Others again were marked "Uninhabited" because the family had gone away for a holiday though, as a matter of fact they were not "To Let." Houses are very scarce in most of the populous centres of this State, the rents are very high, and in a large number of cases several families divide a house.

#### REFUSAL TO SUPPLY INFORMATION.

It is pleasing to report that no necessity arose for an appeal to the law. Numerous difficulties were encountered chiefly in the City of Adelaide, where the collectors received absolute refusals. These were due mainly to the ignorance of the parties concerned, and in other cases to boarders objecting to pass their cards through their landlady. By the exercise of considerable tact and the intervention of the enumerator every such objection was overcome. In only a few cases was it necessary for the Supervisor to send warning letters to troublesome people.

#### WEATHER.

Generally speaking, throughout the whole settled portion of the State, ideal weather prevailed during the whole process of distributing and collecting. The prevalence of droughty conditions throughout the Far Northern Division of the State, and the presence of floods produced by monsoonal rains in the Northern Territory, were the only disturbing climatic conditions reported.

#### SPECIAL ARRANGEMENTS FOR ENUMERATION OF TRAVELLERS.

Travellers on Trains.—With the exception of the railway service from Broken Hill to Adelaide, and a Sunday-night train from Port Pirie to Petersburg (to meet the Broken Hill express), the entire railway service in South Australia is suspended between midnight on Sunday and 5.30 a.m. on Monday, consequently the only arrangements necessary to be made were in these two cases, the exigencies of the occasion being met by the appointment of the guards of the respective trains as collectors.

Travellers on Ships.—As regards coastal shipping within the State, the various enumerators instructed their collectors to deal with same in accordance with the printed instructions—the enumerator in each case personally interesting himself to see that the steps taken were effective; this he also did as regards shipping generally. With respect to the River Murray traffic, the several enumerators of the area through which the river passes conferred with each other so as to ensure travellers on all vessels up and down being recorded.

# POLICE.

It was not considered necessary to make any special arrangements with the police respecting persons who may have been travelling or camping out on the night of the Census. The various collectors were instructed to make careful enquiry as to these, and further, the advertisement which appeared later directing all who had not furnished Census cards to apply to the nearest Post Office appeared to meet all requirements. Of course, it must be admitted, that it is impossible to prevent a percentage of such persons from being missed, and hence it might be advisable to make a small allowance for them.

# INTERPRETERS.

At Port Adelaide it was necessary to employ three interpreters, all being officers of ships in harbour; they being one Chinese, one Swede, and one Manilaman. At Palmerston two Chinese interpreters were employed in the Chinese quarter of the town.

# VESSELS IN PORT.

The enumeration of persons aboard vessels in South Australian ports was carried out according to instructions by the collectors under the special supervision of the enumerators, no hitch whatever occurring. Only in one case was any trouble experienced, that of a Swedish vessel at Port Adelaide, the Captain of which declined to supply the necessary information. A remonstrance from the Swedish Consul, however, had a salutary effect. The enumerator for the Northern Territory reported that he had no difficulty whatever in obtaining Census particulars from all craft lying at Port Darwin.

# DISTRIBUTING AND COLLECTING.

Approximately the range of time taken by collectors in distributing and collecting the returns was as follows:—In the Cities of Adelaide, Port Adelaide and Unley from 12 to 23 days on foot; in the large Corporations from 9 to 19 days on foot; in scattered areas from 10 to 27 days, with use of horse and motor; in the outside country from 10 to 29 days, and in the Northern Territory from 14 to 56 days were taken with horse, motor, or eamel.

In one special case 68 days were taken by a collector to do his work. In this instance the enumerator (District No. 39) found it impossible to find a second collector to traverse the country which was rough and uninviting, and on the collector for sub-district "R" volunteering to do the work, in addition to that of his own sub-district, his offer was accepted.

The difficult and arduous task of distributing and collecting in the Far Northern Division was overcome by the appointment of the Police Inspector as enumerator, and his staff of police officers as collectors—a body of men who know all the country thoroughly. Throughout droughty conditions, scarcity of water, and the presence of poison plant prevailed, causing death and disablement of horses. The work these police officers did as collectors cannot well be overestimated, in all they traversed 13,191 miles, or an average of 694 miles per man.

The Northern Territory was also served by the Inspector of Police as enumerator, and his subordinates as collectors. The vast area of difficult country to be traversed by collectors, with rivers swollen by monsoonal rains, and the necessity of carrying rations with them, made the work of Census collecting in this portion of the Commonwealth a matter of great difficulty. Several horses were lost. The average distance traversed per collector was 640 miles, the aggregate being 7677 miles.

Had the police not been available, the cost of collecting would have been a costly item, therefore these collectors merit a fair bonus.

I wish to acknowledge the splendid assistance rendered by the Metropolitan press, which at all times was ready and willing to publish readable matter on the Census, with the object of educating the people up to a sense of their responsibilities and public duties, a result which undoubtedly they were successful in attaining.

#### PART II.

The immense difficulty of framing a set of instructions for the guidance of supervisors, enumerators, collectors and householders appplicable to each State of a vast Continent, such as the Commonwealth of Australia, must be readily recognised.

Speaking generally, they met the requirements of this State, being, with few exceptions, easy of interpretation. Still, experience has marked out a number of clauses which might with advantage be either altered or rendered with greater clearness.

In supervising the work in this State, I endeavoured, in the first place, to interpret the spirit of the instructions, and then administer as near to the letter as circumstances admitted with reasonableness. I had no hesitation in advising my enumerators to act contrary to the letter in such cases as in my opinion the ends of the Census could be better achieved.

# GENERAL INSTRUCTIONS.

Enumerators' Sub-divisions.—It would be an advantage to supply each enumerator with a plan showing his district as sub-divided into collectors' districts for the previous Census, with the population for each sub-district, and the amount of remuneration paid to each collector. For, unless development or retrogression has materially altered local conditions, much is to be gained by adhreing to former boundaries.

So far as possible I made a special point of advising my enumerators of these details as they related to the 1901 Census

The Maps, Clause 16, Form 8.—It is not quite clear to me from this clause whether or not it was intended to supply the Supervisor with a map shewing each of the subdivisions of the various Census Districts. At any rate I often experienced considerable inconvenience through not having in my possession a large map shewing not only the enumerators' districts, but also the subdivisions. The key maps of enumerators' districts supplied to me were very useful, but on too small a scale. If prepared on a larger scale the subdivisions could be shewn, and the whole mounted.

## EMOLUMENT OF ENUMERATORS.

Clause 4, Form 8.—In order to secure uniformity throughout the States, it might be advisable to draw up a scale of fees for general guidance in estimating the fees of enumerators. It should not be made arbitrary, because some localities would need special consideration. A minimum might be fixed, and a scale prepared for closely populated centres and for scattered districts.

The instructions very properly indicated that a retaining fee would be paid to each enumerator, but in this State the payment was not made, causing general dissatisfaction. In my opinion an advance should be paid as a right when the subdivisions and selection of collectors have been satisfactorily completed, but the amount should be, say 20 per cent. or 25 per cent. of the total fee, as in some cases £10 l0s. would be too much.

In the absence of such advance some enumerators who had to pay for clerical assistance were out of pocket for months. They were practically under engagement for six months, and received nothing until sometime after completion of their work.

It is of great importance that the very best men obtainable should be secured as enumerators, and therefore, in the interest of an accurate Census, the fees paid should be liberal—sufficiently liberal in the larger districts to enable the enumerator to provide himself with the indispensable clerical assistance for speedily checking the returns on delivery after collection. It is an absolute impossibility for an enumerator of a district embracing more than 12,000 to 15,000 persons to effectively do the work of checking and querying back to collectors without assistance, and in my opinion this assistance should either be specially paid for or provided for in the fee. When fixing the remuneration for the enumerators in this State, I took this matter into consideration, and endeavoured to make a slight provision for it.

The detailed checking indicated in Clause 49 of Form 7, if conscientiously attended to involves a lot of work. In my opinion it is of the utmost importance; in fact the accuracy of the Census depends largely upon it, but in order to do it speedily, assistance must be available in the large districts. Therefore, I think the words in Clause 52, Form 7, "You will make arrangements for checking," should be transferred to Clause 49, as the work outlined in Clause 52 is too insignificant to need special arrangements, but perhaps it was intended to read this Clause in conjunction with Clause 49.

# FINANCIAL ARRANGEMENTS.

Rendering Accounts.—To secure uniformity and to comply with audit requirements, the method of rendering accounts for enumerators' travelling and incidental expenses, collectors' fees, &c., should be illustrated. Through the absence of such detail, accounts often had to be queried, causing delay and inconvenience both to the claimant and the Paying Department.

Further, when accounts are sent forward for payment, a list of such accounts, when passed for payment, should be sent to the Supervisor, for otherwise he is entirely in the dark as to the treatment of accounts after leaving his hands. On a number of occasions the absence of such knowledge proved most inconvenient. No doubt a speedier method of settling accounts will be devised in future. The delay in paying small amounts and expenses out of pocket was most annoying to me, as the claimants were constantly beseiging me for payment. I can quite understand, however, that the immensity of the work might have been underrated on this, the first occasion of the Commonwealth Census.

The method of making accounts payable at only one Post Office in an enumerators' district proved a serious source of trouble in outlying centres. Authority might be given to the particular Post Office to forward claims and money, free of exchange, to the Post Office nearest to each of the claimants.

#### ALLOTTING COLLECTORS' DISTRICTS AND PAYMENT.

Clauses 11 and 32, Form 7.—This clause makes 12 days the maximum of time to be allotted to each collector in populous centres. I was unable to adhere to this instruction. Good reliable men could not be secured to take up special work of this kind for only £6, and the inferior class would ruin the reputation of any enumerator, however capable in himself. Therefore, I advised my enumerators to make the districts a little larger, pay more money, and thus be in a position to secure the services of the best class of men. I made a special point of seeing that each enumerator dealt fairly with the collectors as regards the days allowed, and did not hesitate to increase as well as to reduce the number of days if my judgment differed from the enumerator. As a result, very few claims for increased remuneration were entertained by me, and recommended to you.

In my opinion, the best results are obtainable by dividing populous centres into districts of 200 to 250 houses, and allotting 12 to 16 days' time for the work at say 12s. 6d. per diem; 10s. per diem (a shilling more than many a labourer receives), is too low, and will not tempt the right class of men, at least in this State. Many recalls are necessary, and much time is lost in giving information, filling up cards and checking and correcting errors. The work intelligently done is far more than simply delivering and collecting, and 50 houses delivered and less collected in a day of 7 or 8 hours would be an excellent average, and too high for some localities.

Clause 44, Form 7, Stamping Cards.—Had there been sufficient time I could have arranged with the Government Printer to print the headings for all the large enumerators' districts, as the stamping process is very tedious, but nevertheless unavoidable as regards many districts which happen to embrace more than one Local Government area, Hundred and Electoral District.

The system adopted by me for stamping proved eminently satisfactory, as far as I could judge, though your compilers will be in a better position to speak on that point.

#### MESH NUMBERS.

A clear definition of the meaning of these numbers would be helpful in future, and save the Supervisor from replying to many queries.

#### TENEMENTS.

The clauses dealing with these cannot be sufficiently clear, for both enumerators and collectors misinterpreted them. I suggest a special clause with illustrations.

Clause 14. Form 14.—This Clause confused many well-educated enumerators. Many interpreted the last paragraph relating to hotels and large boarding establishments as illustrating the method of numbering tenements. I suggest that in this case, and in all other similar cases, very full illustrations be printed shewing the method of numbering expected to be adopted, by which means uniformity would be secured.

#### CENSUS CARDS.

In the distribution of cards a number of collectors confused the Personal and Householders' Card, the latter being left in lieu of Personal Cards. The printing on the face being so different, it seems strange they should make the error, but the fact is that they did so, and it occurs to me that it might be prevented by having the cards of different colours, which also would be of assistance in checking and probably in compiling.

## SIZE OF CARDS.

Many criticisms appeared in the papers as to the space for replies on the cards being insufficient, and I was also inclined to think the same, but from an examination of the cards as they came in, I came to the conclusion that very little inconvenience was experienced. The more space available, of course, the better.

On the Householders' Cards the two columns for total might be omitted, and the space given to the columns for names.

(Signed) L. H. SHOLL,

Supervisor of Census.

30th September, 1911.

# V.—WESTERN AUSTRALIA.

Referring to previous correspondence re the result of the Census, I beg to submit for your information the following views held by myself in connexion with certain matters which came under my notice in my capacity of Supervisor of the Census of Western Australia taken early in the year.

#### (1) SUBDIVISION OF THE STATE INTO DISTRICTS AND SUB-DISTRICTS.

On account of the generally prosperous condition of the State at the time of the Census, it did not appear at all likely that a large number of suitable individuals could be obtained at the rate of pay offered for the positions of Census collectors, particularly in districts outside the Metropolitan, and the Central Goldfields area around Boulder and Kalgoorlie, and on that account it became a necessity to adopt in the country districts larger areas as collectors' districts than what might have been thought desirable under other circumstances. As a matter of fact, the alternatives were, on the one hand, to appoint a larger number of collectors, amongst whom there would probably, under the circumstances, have been included men who might not be entirely satisfactory, and to cut the districts up into smaller collectors' areas, or, on the other hand, to cut the districts up into larger areas and select only the best men. As you are aware, the latter alternative was adopted, but experience has taught me that at a future Census, in order to arrive at more satisfactory results, an effort should be made, even if the selection of collectors and the distribution of sub-districts were to commence at an earlier date, to provide for a correspondingly larger number of collectors and smaller areas as collectors' districts. It is apparent that, if good men can be obtained for certain localities which are well-known to them, it is difficult to find individuals who would know a larger area as much in detail as they would know a smaller one, and there is a danger therefore of the Census enumeration in one portion of a large district being done more efficiently than in another; in addition to which a large district has the disadvantage of the Census being spread over a longer period, and consequently more danger arising from the fact of individuals moving to and fro in the district whilst the Census is being taken, which might result in omissions that could be ascribed neither to a dereliction of duty on the part of the collector,

Moreover, in a State containing such a large area as Western Australia, it would appear necessary that the authority of supervision should in some way or other be divided, as it is nearly impossible for one man to shoulder the responsibility of the whole of the vast area referred to. Whether such object would be easier arrived at by dividing the State up into several Supervisors' Districts, or by appointing Deputy-Supervisors for certain portions of the State, I am not prepared to say; possibly the latter suggestion would be the more practical. I am aware, of course, that the enumerators' districts should be sufficient as subdivisions under the Supervisor, but under the special circumstances in this State, I think an officer holding authority between the Supervisor and the enumerators in the Northern portions, and the far Eastern portions of the State would be an acquisition to the enumeration.

#### (2) TIME FOR COMMENCING PRELIMINARY WORK.

Although I claim to have a fairly extensive local knowledge of the various portions of the State, I think it would be well to consider at the next Census whether it would not be in the interest of an efficient subdivision that the preliminary work be taken in hand nearly two years ahead of Census day, and that in many instances the Supervisorshould be placed in a position to make personal inspection of the distribution which was being suggested, not only by himself, but by the enumerators in each district. Since this work was completed, I have often felt that if I had had to do the work over again, not only time but expense would be saved had I the opportunity of visiting certain portions of the State for the purpose of arriving at the most efficient and economical subdivision.

#### (3) ADVERTISING THE CENSUS.

No doubt the means taken for advertising the Census proved of great value, but a matter which I desire to remark on is the fact of the poster issued by the Department for exhibition only containing the proclamation issued by His Excellency the Governor, setting out the time fixed for the taking of the Census. In my opinion, backed up by the experience gained in advertising electoral canvasses, and the preparation of new rolls for the Legislative Council and Legislative Assembly, another poster containing more particulars should have been prepared and exhibited. In order to show what I mean, I attach hereto copy of a poster exhibited in this State at the time of the preparation of the rolls for the late Legislative Assembly Election, from which you will observe that particulars are given which would enable the individuals concerned to get a fuller grasp of what is required. Such a poster, if exhibited freely, would meet the eye of persons whom the collector had missed, and directions would be given on the poster to such persons where to procure and how to fill in and transmit the particulars asked for by the Authorities. I am aware that this was done at the Census in a different way, viz., by means of advertising in the local newspapers, but it should not be forgotten that the country transmit the particulars asked for by the Authorities. I am aware that this was done at the Census in a different way, viz., by means of advertising in the local newspapers, but it should not be forgotten that the country people, more particularly the individuals who roam about from place to place, very seldom obtain or read newspapers, and that probably the advertisements would, therefore, not come under their notice. If, on the other hand, these posters were exhibited freely all over the State, it is more likely that attention would be drawn to the requirements of the authorities, and possibly a distribution of cards for the purpose of enabling individuals to voluntarily supply particulars might be lodged for the convenience of the public, not only at Post Offices, but at many other public and semi-public offices.

#### (4) THE CENSUS CARDS.

With reference to the Census Cards ("Householders' and Personal"), I think there would be an improve-

With reference to the Census Cards ("Householders' and Personal"), I think there would be an improvement if these were printed on differently-tinted cardboard, as some trouble was met with in drawing the attention of the public to the fact that the cards were to be used for different purposes; in fact, a largenumber of forms were returned to the Supervisor either on the "Personal" Card only, or on a "Householder's" Card only. I think that the difference in colour of the two cards would draw the attention of the public to the distinction between the one and the other more readily than is at present the case.

It would also be desirable to set out on the two cards in the same manner as set out on the "Householder's" Card by a side-note, what portion should be filled in by the individual, and what portion should be filled in by the Census officials. This advice is prompted by the fact that a large number of cards were received in this office, and the information, on the "Householder's" Card for instance, was filled in by the individual, as regards "County," "Federal Electoral Division," "State Electoral Province," "State Electoral District," &c., &c., and was found in nearly every case to be inaccurate. This matter entailed alterations which made the card very difficult to decipher and deal with when finally completed.

#### (5) PERSONAL CARD.

So far as the Personal Card is concerned, I would say that one item, viz., No. 7, "Relation to head of household," is one which seems to be misunderstood in very many cases. As a matter of fact, I think the general view taken of the headline was that it required to indicate what relation the individual held to the head of his own family, whether he was living with them or not. I am not sure whether the Census Returns would lose considerably by the line being eliminated, but I certainly think that some other wording should be substituted. be substituted.

## (6) MAPS.

The maps used at the recent Census in Western Australia were, as you are no doubt aware, unsatisfactory, as the Survey Office, at the time when the maps were required, had unfortunately not completed a new set of maps then in hand, containing the most recent and up-to-date particulars of land settlement, mining leases, &c., &c., and the lithographs, which were finally adopted by the Census Office were, therefore, to a very large extent, at least for certain portions of the State, out of date. This matter, in conjunction with the scale of maps adopted for the use of collectors, viz., 240 chains to the inch, militated against a complete enumeration in certain districts, as the collectors had not at their disposal the necessary details they would have had if the new maps had been ready for use. At a future Census, I should think, therefore, it would be extremely desirable that either special Census Maps be prepared, or arrangements made by the local Survey Office for the supply of maps more up-to-date than those used in this State at the 1911 Census. It is also very doubtful whether the scale of 240 chains to the inch, or 300 chains to the inch, is sufficiently detailed for a collector. The adoption of maps on the scale of say 80 chains to the inch would, of course, very considerably enlarge the maps to be carried by the collectors, but from experience gained, I have no hesitation in stating that expense and the inconvenience of carrying a larger map would be more than compensated by the better results that would be obtained.

# (7) THE RESULT OF THE CENSUS OF 1911.

The result of the Census of 1911, so far as this State is concerned, has already been referred to by myself in my letter to you of the 13th June last, to which I beg to refer you. There is one point I desire to again dwell upon, viz., the discrepancy which was found to exist in this State between the Census results and the estimate made by the Government Statistician of this State. After having still further considered the matter, I am of opinion that the  $4\frac{1}{2}$  per cent. which was allowed for unrecorded departures from this State between the Census of 1901 and the year 1908, when it was discontinued by the local Statistician, was altogether an insufficient allowance. My reason for making this assertion is based upon the well-known admission, that during the previous

intercensal period, 1891 to 1901, a very large number of unrecorded arrivals occurred in this State, on account of the great inrush of population, particularly during 1895 and 1896, these incomplete records of arrivals being accounted for by the fact that admittedly the Steamship Companies carried more passengers than they were entitled to, and that consequently the official record of arrivals may be looked upon with suspicion, which fact was not taken into account when the  $4\frac{1}{2}$  per cent. allowance was fixed by the Conference. I beg to draw your attention to the fact that if the average experience of Australia, say about 9 per cent., had been applied during the intercensal period of 1901 to 1911, the difference between the estimate and the actual Census result would have been very small indeed. Should an investigation at any time be decided upon with regard to this particular subject, I would suggest that the actual corrections of the departure returns should be compared with the result that would have obtained if the  $4\frac{1}{2}$  per cent. allowance had been continued.

# (8) CONCLUSION.

The above suggestions are placed on record only with the object of drawing attention to these matters, which may at a future Census be found to be of some assistance, and are not actuated by any desire on my part to criticise the provisions made for the taking of the 1911 Census, nor the results arrived thereat. I have endeavoured to confine myself to the main features only, which, in my opinion, may be looked upon as important.

(Signed) E. G. STENBERG, State Supervisor of Census, Western Australia

7th December, 1911.

#### VI.—TASMANIA.

In your letter dated 19th May last, you ask that I should furnish you with a brief report on the main features of the recent Census in Tasmania, and to include therein an indication of any special difficulties met with, and any features which I might regard as specially appertaining to the State of Tasmania.

You also stated that you would be glad to receive suggestions for obviating such difficulties as may have been experienced, or suggestions for the better conduct or organisation of future Censuses, or counts of the population.

In accordance with such request, I have now the honour to submit the following report:-

#### DIVISION OF THE STATE INTO PRIMARY CENSUS DIVISIONS.

In previous Censuses of Tasmania the primary Census Divisions were invariably based upon, and coincided with, the Electoral Districts of the House of Assembly as constituted at the time. These Electoral Districts of the House of Assembly prior to year 1881 varied from 30 to 35 in number, and, outside of the two cities Hobart and Launeeston, formed, in a rough, mountainous, and densely-wooded country like Tasmania, a convenient, and a fairly manageable size or boundary limit for the effective supervision of any single person, with local knowledge, acting as enumerator. Since the taking of the 1901 Census, the Electoral Districts of the House of Assembly in Tasmania were reduced to five, and, consequently being too large, were no longer suitable as a base for determining the primary Census Divisions. The newly-organised municipalities, 51 in number, with their well-defined ward subdivisions, now presented the most suitable base in Tasmania, for determining the primary and other Census subdivisions of the State, for the enumeration of the people in 1911.

It was such considerations which induced me to suggest for your approval my original scheme for the creation of 35 Census Districts, 19 of which were identical with the respective boundary limits of 19 independent municipalities, and each of the remaining 16 Census Divisions were made, in each case, of the area covered exactly by every adjacent pair of the remaining municipalities, of which there would be 32 so grouped. On further consideration, the original scheme was modified, and finally reduced to 23 primary Census Divisions by a further combination and amalgamation of distinct municipalities, in order to conform more closely to the magnitude of Census Districts then contemplated for adoption throughout the other States of the Commonwealth.

# 'SELECTION AND APPOINTMENT OF ENUMERATORS.

Much greater difficulty was experienced in securing and obtaining the consent of suitable persons to act as enumerators for the Census of 1911, than was experienced at the two previous Censuses (1891 and 1901), for which I also acted as Supervisor.

To facilitate and ensure the selection and appointment of suitable persons to act as enumerators, I addressed a circular to the Wardens of the various municipalities throughout Tasmania as early as the 15th July, 1910, briefly specifying the nature and extent of an enumerator's functions, and of the qualifications requisite to efficiently fulfil the duties of enumerator; and also soliciting the kindly assistance and co-operation of each Warden and his Councillors in the selection of a suitable person to act as enumerator in their immediate Census District. The circular also solicited the consent of the municipal authorities to the appointment of any Council clerk who might be chosen as the most suitable person for the office.

For many reasons it was very desirable to give preference to Council clerks in such appointments.

Eventually, the consent of 14 Council clerks was obtained, and in due course, with one exception, they discharged their prescribed duties in a satisfactory manner.

For nine of the Census Divisions I failed to secure the services of any of the Council clerks located within the particular Census Division, and much difficulty, and unfortunately much loss of time, occurred before I could obtain the consent of suitable persons to act, who were, at the same time, sufficiently acquainted with the topography of the particular Census District concerned.

Apart from the size or extent of an enumerator's Census District as affecting the powers of an enumerator to judiciously and effectively break up his district into as many subdivisions as would enable one collector to carry out the duties of collector within the limits of time prescribed in the printed instructions, it is of the utmost importance that each enumerator of a Census District should have an intimate acquaintance with the topographical character of the district under his charge; sepecially so as regards the rivers, roads, and bushtracks of the larger pastoral areas, and of the sparsely-populated, and sometimes almost impenetrable and densely-wooded parts of Tasmania's principal mining and timber regions. It is also desirable that he should have resided sufficiently long within his district to be able from personal knowledge to make judicious choice of each one of his assistant collectors, and to allocate them to the particular subdivision with which each has given evidence of being best acquainted. It is only in such way that the proper number of collectors' subdivisions can be safely determined, and only with such knowledge can a fair allowance of time and mode of travel be approximately fixed prior to the time when the work of the collector is actually engaged upon.

# ALLENDIA

# DIFFICULTIES EXPERIENCED IN THE SELECTION OF SUITABLE PERSONS TO ACT AS LOCAL CENSUS COLLECTORS.

In densely populated countries, closely intersected by railways, roadways, and with every facility for transport and communication, especially so where a more or less perfectly-trained staff of permanent officers can be engaged as local distributors and collectors of Census schedules, the duties may be most specially and efficiently carried out, even where the range or extent of particulars relating to individuals, households, and even special industries, are extended far beyond the usual limits of Census enquiries; but practical experience, gained in the work of Supervisor of three succeeding Censuses in Tasmania, has convinced me that, when, in a large measure, a staff of officers has to be suddenly engaged temporarily at a given point of time (and even then only for a period of from 7 to 12 days), the standard of efficiency in a number of cases cannot be expected to be of a very high order, expecially when we consider that the majority, of necessity, has to be drawn from such limited local persons as may have spare leisure time or from those in such a neighbourhood who, from various causes, may happen to be temporarily out of employment. The range of Census enquiries, and the work imposed upon collectors selected in this haphazard way cannot be incautiously extended without either the danger of unduly increasing the number of days engaged in the work, or having the duties carried out in a careless and unsatisfactory way. Unfortunately this experience was in a number of instances too closely verified in several of the enumerators' Census Districts of Tasmania at the latest Census.

It is only after the work is practically engaged in that the defects of those appointed as collectors on the nomination of local enumerators are discovered, and then, it is often impossible or too late to replace them with a more suitable officer. In one or two cases the whole work of the collector had to be covered by a proved officer when the work of the originally appointed collector had been discovered to be altogether untrustworthy.

# EXTENT AND COST OF ENUMERATION AS COMPARED WITH THAT OF THE PREVIOUS CENSUS.

Compared with the previous Census of 1901, the time taken in the work of enumeration alone, and the estimated cost in connection therewith, has considerably increased, both in relation to population, and to the extent of area covered by the enumerating staff. This is indicated in the following brief abstract:—

Particulars.	Census 1901.	Census 1911.	Increase or Decrease.			
Area in square miles			No.	26,215	26,215	
Estimated population			,,	172,475	190,972	+18,497
Census Districts			,,	31	23	<b>-</b> 8
Collectors			,,	390	346	<b>— 44</b>
Average persons enumerated per collecto	г		,,	442	552	+ 110
Average square miles per collector		• •	,,	67	76	+ 9
Time taken by collectors—Days			,,	2,178	3,418	+ 1,240
Ditto. per collector			,,	5.58	9.88	+ 4.30
Estimated cost of enumeration		• •	£	1,888	3,500	+ 1,612
Per square mile				ls. 5d.	2s. 8d.	+ ls. 3d.
Per head of population				2.62d.	4.40d.	+ 1.78d.

OBSERVATIONS REGARDING COMPARATIVE INCREASE IN COST AND INCREASE IN TIME OCCUPIED BY COLLECTORS IN THE WORK OF CENSUS ENUMERATION IN 1911, AS CONTRASTED WITH THE RESULTS OF PREVIOUS CENSUS.

The larger amount of time occupied by collectors in the work of enumeration of Census in 1911, and the consequent greater cost, as compared with the results of the previous Census, have arisen from several causes, the principal of which are more fully analysed in the following comments:—

(1) By direction the majority of enumerators were selected, in preference to others, from one or other of two or three Council Clerks of the municipalities grouped to form the primary Census Division, or Enumerator's District. Although in every other respect well-fitted for the duties of an enumerator of Census, they were nearly all new to such special work. Being comparatively new residents in recently organised Municipal Districts, and having no direct official relationship with the one or two adjacent municipalities, which, for Census administration, were amalgamated with their own respective municipalities, they were not quite so familiar with the topography and local matters of the more distant parts of the Census District, as were the older resident Wardens and Police District Inspectors of the older local administrative bodies, from whom the enumerators were mainly selected at the previous Census.

As a consequence, it was afterwards discovered that a considerable number of them lacked that precision of local knowledge which would enable them, beforehand, to fix the number, boundary limits, and time of collectors, in such a way as to bring about the best practical and economical results.

From this cause alone, a great deal of trouble arose afterwards, when the collectors, selected by the enumerator for a particular subdivision, either objected to the time for emolument originally allowed for the work of distribution and collection of schedules, or stubbornly insisted, in some cases, upon reducing the limits of the original collecting area mapped out for them.

In such cases of emergency submitted to me by the enumerator of the Census District at the very last moment, I had often no option but to consent to the slight modifications of either time or boundary limits commended by him. This course had, perforce, to be decided at once, as a single day's delay might, in some cases, jeopardise the success of the Census in that particular district.

(2) Apart from the additional cost of enumeration due to the increase of population over the previous Census (increase, 18,947 persons, or 10.73 per cent. greater), there was another important increase in cost due to the fact that, at the previous Census of 1901, a larger number of the mounted police of country districts were employed as collectors than so employed at the last Census of 1911; and as the former, for the most part, were allowed by the Police Department a Forage Allowance, they were only paid for Census work at the rate of collectors on foot, viz., 10s. per day.

Had the collectors on horseback and others been paid for Census work at collectors' foot-rate, viz., 10s. per day, the same as the horseback collector in 1911, it would have had the effect of raising the amount of collectors' emoluments in 1901, from £1641 to about £1991, representing a difference of £350, or nearly ½d. per head of population.

The total amount of collectors' emoluments, and the time taken by collectors, as well as the percentage of the work of collection by means of foot, horse, and otherwise, at the Census of 1901 and 1911 respectively, are contrasted in the following abstract:—

TIME ABSORBED AND COST OF COLLECTION AT THE CENSUSES OF 1901 AND 1911 RESPECTIVELY.

		Particu	lars.		19	01.	191	11.
Collectors engage Population Collecting—	ed		••	 No.	390 172,475	<u>%</u>	346 190,972	<u>%</u>
On foot	•			 Days	999	48.56	848	24.82
On horse		•		 ,, ;	1,100	50.54	2,351	68.67
Other	• •	• •	• •	 ,,	79	3.40	219	6.41
Total	••	• •		 ,,	2,178	100.00	3,418	100.00

# ESTIMATED COST OF COLLECTION, EXCLUSIVE OF ENUMERATORS' PRESCRIBED FEES AND OTHER INCIDENTAL EXPENSES.

Cost of Collection— On foot On horse Other Special allowance	• • •	·· ·· ·· · entries (	  Col. Book	••	£ ,,	499 } 1,142	% 30.41 69.59	424 ( 2,351 ( 182 86	% 13.94 77.26 5.98 2.82
Total	••		••		£	1,641	100.00	3,043	100.00
Cost per collector		••			£	4.21	-	9,79	
Cost per head	• •	• •	• •	• •	•••	2.28d.		3.82d.	_

The adoption of the separate personal and householder card system of emuneration has added greatly to the work and responsibilities of Census collectors.

Beyond the influence which increase in population and the other causes, referred to previously, may have had in augmenting cost, and time occupied in the work of collection and distribution of Census forms at the last enumeration, the primary cause of increased cost and time occupied by collectors, is undoubtedly due to the much greater work and responsibility imposed upon the latter by the new method adopted in 1911, in collecting information by the separate personal and householder card system.

Prior to the actual Census day each collector on the Tasmanian Census of 1901, had only to deliver to each household or dwelling one schedule combining all particular queries relating to dwelling and to each person who abode therein on Census night. As a single collector might have to arrange for the distribution of 300 schedules relating to say 1500 persons prior to Census day, it is very desirable where there are so many schedules to number specifically for after identification, that the work of the collector in writing out particulars beforehand, as to locality or district boundary names, should be restricted as far as possible. For this reason it was absolutely necessary to devise a systematic index to every possible concatenation or "Mesh," formed on map of Tasmania by the separate and distinct boundary lines of all the various kinds of divisions or districts to be taken into consideration in the process of enumeration. As this ultimate unit "Mesh" is simple and common to every kind of division or district, its Index No. (e.g., 10/3a.) alone would suffice for tabulation purposes, to identify every form of geographical division or locality. Accordingly the Tasmanian Census Schedule of 1901 only required the collector to fill in particulars relating to four items or queries prior to distribution on Census day, viz.: (1) Schedule No.; (2) Mesh No.; (3) Locality; (4) Road or Street.

If we now contrast the above with the additional preliminary writing on covering envelope and householder and personal cards by collector, as required by the Census of 1911, in relation, for example, to a household of ten persons, as illustrated in the following tabular comparison of the two different methods, we find, that while in the 1901 schedule only four preliminary entries had to be written in prior to delivery, the requirement of the 1911 Census involved the writing in before delivery of cards, &c., of not less than seventy distinct entries by the collector. By experiment at central office and from inquiries made among collectors, I found that the average collector took two hours per hundred cards to write up the preliminary query answers. I estimate that this alone would add two extra eight-hour days to the distributing part of the work of each collector employed on the Census of 1911, in Tasmania.

TABULAR ILLUSTRATION SHEWING THE ADDITIONAL WORK IMPOSED UPON COLLECTORS PRIOR TO CENSUS DAY, 1911, BY THE SEPARATE HOUSEHOLDER AND PERSONAL CARD SYSTEM, AS CONTRASTED WITH THE CORRESPONDING REQUIREMENTS BY THE TASMANIAN CENSUS OF 1901.

Œ	OR	ONE	Household	OF	10	PERSONS.	)

*		Single			CARD SYSTEM, CENSUS 1911.			
Item.	Particulars.		Schedule System. Census 1901.	Schedule Envelope.	House- holder's Card.	Personal Cards, 1 x 10 = 10		
1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18.	Schedule  Mesh  Locality Street, Road, &c. Envelope Blank Forms (A)—delivered Blank Forms (B)—delivered Envelope Envelope—Instruction (A) Envelope—Instruction (B) Collectors' Districts Census District County Electoral District Logislative Council District Municipality Ward Personal Card	No Name No No No No No No Name " Name " No Name	27 20 1 Derby Main-road nil nil nil nil nil nil nil nil nil nil	nil 20 1 nil nil 27 10 1 Mr. Miller 10 1 "B" VIII. nil nil nil nil nil nil 9	27 20 1 Derby Main-road nil nil nil nil nil sil Nil Service Bass South Esk Ringarooma Moorina nil	each one.  27  20  1  nil  nil  nil  nil  nil  nil  nil		
	TOTAL WRITTEN ENTRIES		4		70			

REFERENCE KEY TO THE VARIOUS INDICES AND NAMES OF DISTRICT DIVISIONS MUST BE CONSTRUCTED FOR, AND CAREFULLY CONSULTED BY COLLECTOR WHEN ENGAGED IN WRITING UP PRESCRIBED PARTICULARS ON SCHEDULES, CARDS, ETC., PRIOR TO HOUSEHOLD DELIVERY.

The collector chosen by the Census enumerator of a Census District may find that his collector's district embraces, and is composed of, from three to five distinct "Meshes." Take, for illustration, an actual case in the Census District of Franklin at the last Census enumeration in Tasmania:—

Mr. T. E. Bentick, appointed to the care of Collectors' District (H), found, on reference to his Boundary Map, that his district embraced, and was composed of five specific "Meshes," viz., 51/la, 51/lb, 51/lc, 51/ld, 51/le of Strahan East Ward (51/1); and of Strahan Municipality (51).

The separate card system required Collector Bentick, of District "H," writing certain prescribed particulars, in different places, upon one or more of either envelope, household card, or personal card, and shewing against person or house the appropriate index-number, or letter, or name, as the case may be, relating to the different divisions recognised, and to all of which the adopted specific "Mesh" is an ultimate root-unit, common to all divisions.

For such an officer with little or no previous training to such work, and only engaged temporarily for about 12 days, to write down correctly, in different places, answers to 70 queries relating to the localities, indices, and names of different kinds of divisional boundaries, to which any particular "Mesh" may commonly be related, would be practically impossible, unless a Key had been previously carefully prepared for his guidance.

Such Key must be so prepared as to shew at a glance, against each "Mesh" separately, all the information required to answer the particular queries prescribed in the various cards and envelopes to be delivered.

Such a Key was prepared beforehand, by the State Supervisor. A copy of the form of the Key transmitted to Collector Bentick, along with his District Map and other equipment, is here given by the way of more satisfactory illustration:—

#### TASMANIA.

#### Schedule to accompany Collector's Plan or District Map.

COLLECTOR'S DISTRICT, "H.',  $\frac{51}{(1a, 1b, 1c, 1d, 1e.)}$ 

CENSUS DISTRICT—FRANKLIN (XXI.). MUNICIPAL DISTRICT—STRAHAN (51).

			Index or Name of-							
Mesh.	COUNTY.		Electoral Division, Federal and State.*		State Legislative Council District.		Municipal Ward.			
	Name.	Index No.	Name.	Index No.	Name.	Index No.	Name.	Index No.		
	Montagu	XVII.	Darwin	II.	Gordon	VIII.	Strahan E.	-51 1a		
51 1b	Franklin	xv.	,,	,,	"	,,	,,	$\frac{51}{1b}$		
51 1e	Montgomery	XVI.	,,	,,	,,	,,	,,	- <u>51</u>		
$\frac{51}{1d}$	<b>,,</b>	<b>,,</b>	Franklin	IV.	"	,,	,,,	51 1d		
-51 le	Arthur	XIV.	",	,,	"	"	, ,,	51 le		

<sup>\*</sup> State and Federal Electoral Districts are identical in Tasmania.

OBSERVATIONS RELATING TO EFFICIENCY OF CHECK AND TIMELY CORRECTION OF OMISSIONS AND INACCURACIES THAT MAY OCCUR IN THE ANSWERS TO THE VARIOUS QUERIES AS RECORDED ON CENSUS SCHEDULES AND CARDS.

It is obvious that unless omissions or inaccuracies are discovered and corrected by the collector of Household and Personal Census Cards at the moment of final call, the discovery afterwards, either by Enumerator or State Supervisor, or Tabulator, would only be of negative value. At this important stage, therefore, the greater the facility given to collectors for the immediate discovery of defects, the more perfect will be the results of the Census enumeration. The general consensus of opinion in Tasmania among those who have had practical experience of the operation of the older single comprehensive Householder Schedule, and the new separate Householder and Personal Card system, is greatly favourable to the older method, because of the much greater facility it affords to the collector to discover omissions and defects by contiguity and comparison of the same category, for all persons of the same household, and unerringly guided aright by the vertical column arrangement of categories and instructions.

#### OTHER ADVANTAGES OF THE OLDER SINGLE HOUSEHOLDER CENSUS SCHEDULE.

- Of several advantages which the older schedule possessed the following may be noted:
- (1) It greatly reduced the number of printed forms required for Census enumeration.
- (2) It required no additional summary of names and sex of inmates of household.
- (3) There being provision for the enumeration of at least twenty persons on every schedule there was little chance of omissions.
- (4) While the separate Personal Card system possesses the advantage of securing greater privacy to travellers from home, and to occupants of hotels, lodging houses, public institutions, and such like, it lacked the security and greater assurance of freedom from age-inaccuracy and other defects, by the older mode of making the head of the household responsible for the accuracy of the information recorded on schedule in relation to the members of his own family, and to other inmates of the household, if any.
- (5) The vertical column arrangement of categories, for all inmates of the same household, as in the Tasmanian schedule of 1901, gave greater facilities than the separate Personal Card system, for checking omissions, inconsistencies, and inaccuracies. To do this work properly required much greater care and concentration of attention on the part of the collector by the card system; a single glance along the vertical column of the particular category would at once easily disclose omission, inconsistency, or other defect, by the older single schedule method.
- (6) One of the disadvantages of the older single schedule was that only for certain purposes could it be used for purposes of tabulation. With the Personal Card, as adopted in the last Census of the Commonwealth, tabulation, under all categories, can be directly proceeded with.

It was necessary by the single householder schedule to appoint a staff of trained officers to prepare from the original entries, all the information required for tabulating purposes, on cards specially devised for facility of handling, and for the rapid combinations and analysis involved in the intricate work of tabulation.

# OBSERVATIONS REGARDING THE PREPARATION AND USE OF TABULATING CARDS.

The preparation of Tabulating Cards by trained officers at the Central Bureau has the advantage of having this important work more carefully and correctly prepared with all conveniences and references at the quiet of the office desk, and undistracted by the unfavourable conditions under which the temporarily employed travelling Census collector worked.

Moreover, the trained officer, at this more favourable stage, would also do the work of scrutineer of schedule entries, and correcting and making good omissions and mistakes as far as possible, while engaged in the work of extracting the abbreviated details required for tabulating the various categories on the specially printed cards.

These cards, at the Tasmanian Census of 1901, were far more convenient for the speedy and accurate tabulation of the various categories, in many respects, than the more cumbrous form used at the last Census, thus:—

- (1) The size was only about one-seventh that of the card used at the last Census; was stiffer, smoother, and could be more easily shuffled and counted under the various permutations under some constant or other category.
- (2) With such a constant to work upon as a base, the number, under the various categories conjoined could be readily determined without disturbing the basal constant common to the various categories concerned.
- (3) The cards used at the Tasmanian Census of 1901 greatly assisted the tabulator in having the sexes and the great distinction of breadwinners and dependents and other important divisions distinguishable to the eye by particular colours and cross bars.

#### TABULATING RESULTS OF CENSUS ENUMERATION.

MERITS OF THE SYSTEM ADOPTED IN TASMANIA OF ASCERTAINING THE SIMPLE ENUMERATION OF POPULATION WITH SPEED AND ACCURACY, UNDER THE VARIOUS GEOGRAPHICAL AND OTHER DIVISIONS BY THE DIRECT REFERENCE TO THE SYSTEMATICALLY ARRANGED TOTALS SUMMARISED IN THE STATE SUPERVISOR'S "MESH" INDEX RECORD BOOK.

The minute and complex analysis regarding age, birthplace, conjugal condition, education, occupation, and other prescribed Census categories, which are determined by reference to specifically arranged combinations of the householder and personal tabulating cards, need only be carried out in all their fulness, in relation to only one of the complete divisions (the Basal) into which a State may be most conveniently divided. In Tasmania the Municipal were so chosen.

The tabulation of the mere numbers and sex of the people inhabiting any subdivision such as Ward, County, Electoral District, Municipal District, Legislative Council District, or Census District, does not necessitate the very laborious compilation from the units of each personal or householder card. The numbers of such divisions can be determined, quickly and accurately, with even less than one-five-hundredth of the labour and risk of error, by the direct compilation of specific "Mesh" totals contained in State Supervisor's Record Book summaries.

For particular illustration let us take the case of determining the population of the County of Buckingham.

If we wish to determine the population of this county we may readily obtain it from the summation of only 22 distinct totals, abstracted readily from 11 places in State Supervisor's "Mesh" Record Book.

To obtain the same information from the separate tabulating card process, would—apart from the great risk of the importation of a fresh source of error—involve the handling and shuffling of at least 10,000 separate householders' cards.

Again, take for illustration the case of the simple determination of the population of the Legislative Council District Huon (xii.). By direct reference to State Supervisor's "Mesh" Summary Record Book, and to this officer's Legislative Council "Mesh" Compilation Book, we perceive that the total population of the Legislative Council District of the Huon, may be readily obtained from the summation of only eight distinct totals, taken from six places in State Supervisor's "Mesh" Record Book.

To obtain the same information by the fresh combinations of the individual cards, would, apart from the risk of introducing a fresh source of error, involve the hand-shuffling and counting of about 3000 house-holders' cards.

DESCRIPTION OF STATE SUPERVISOR'S METHOD FOR PROMPTLY AND SYSTEMATICALLY RECORDING AND SUMMARISING THE ROUGH RESULTS OF THE CENSUS ENUMERATION AS RECEIVED FROM THE VARIOUS DISTRICT ENUMERATORS DURING THE ACTUAL PROCESS OF CENSUS-TAKING.

At the outset of the work of Census taking in the State of Tasmania in 1911, I was very anxious regarding the primary compilations of the results of collectors and enumerators as they came to hand in the office of the State Census Supervisor, and accordingly I took charge of this particular duty personally.

To ensure the greatest measure of accuracy possible I took the following precautions:-

As soon after fixing definitely the details of the "Mesh" or "Meshes" forming each separate Collector's District, as finally determined by local enumerators of Census Districts, I prepared, in triplicate, special compilation Record Books. These books (State Supervisor's "Mesh" Record Book) were specially designed and ruled off to shew connectedly for each "Mesh" the enumeration details and totals of the following:—

- (1) Details and totals of each Municipal Ward.
- (2) Details and totals of each Municipality.
- (3) Details and totals of each Census District.
- (4) Details and totals of each Collector's District.

Under particular vertical columns were also shewn the following additional information in respect of each "Mesh":—

- (1) Name and Index-Number of Electoral District.
- (2) Name and Index-Number of State Legislative Council District.
- (3) Name and Index-Number of County.

From these again were compiled the first rough results of the population of each of the principal subdivisions relating to each class of district respectively. One of the Triplicate Compilation Record Books was used, in the first place, to record at once the earliest telegrams and reports of population from the enumerators, in accordance with printed instructions. Each particular was at once entered separately in its systematically arranged place. Later additions or amendments were at once made good, as they were reported.

When all such entries and amendments were finally completed, I at once prepared clean copies of all the Compilation Record Books referred to, which were despatched to you on 30th May last. I am confident that these Compilation Record Books, based directly upon "Mesh" totals, will be of some help hereafter to tabulators and compilers in your department in comparing and checking results obtained by independent compilations from the individual Householder and Personal Cards.

#### CONCLUSION.

In concluding my report on the working of the recent Census in Tasmania, I have the honour to state that I have endeavoured, as far as I was able, to comply with your request as set forth in your communication of 19th May, 1911, viz.—To report on the main features of the recent Census of Tasmania; to indicate the nature of special difficulties met with in the processes of Census-taking by means of the separate Householder and Personal Card system, used for the first time in Australia; and to make such suggestions as might occur to me for securing "better conduct or organisation of future Censuses, or counts of the population."

My report has greatly exceeded the limits I had originally intended, but the importance of the subjects dealt with, and the difficulties of compression, must be my excuse.

Attached to this report I transmit the latest figures relating to the distribution of population under the following divisions:—

- (1) Municipalities and Wards.
- (2) Electoral Districts.
- (3) State Legislative Council Districts.
- (4) Counties.

As regards the additional questions referred to in your communication of 10th June last, I thought it advisable to deal with them separately in an accompanying supplementary report.

(Signed) R. M. JOHNSTON, State Census Supervisor, Tasmania.

15th July, 1911.

# SUPPLEMENTARY REPORT.

# WEATHER.

For about three weeks prior to Census night the weather in Tasmania was the worst experienced for many years, especially in the North-east and Eastern part of the Island. This interfered to some extent in the distribution of Census Cards, inasmuch as in these parts nearly all bridges, etc., were completely swept away, or made impassable. The first part of the week immediately preceding Census day, the weather was very bad indeed, and it caused a good deal of hardship amongst the collectors in the larger areas.

The only difficulties outside those experienced by collectors in obtaining information for schedules were in regard to the Islands, Lighthouses, etc., but with the cheerfully-rendered assistance of the Secretary of the Marine Board, Hobart; Messrs. Holyman and Son, Launceston; Head Lighthouse-keepers, etc., these were easily overcome.

The Government Statistician of New Zealand kindly obtained schedules relating to Macquarie Island. Other islands off the coast were accounted for by the most convenient and cheapest methods available, principally by fishing boats. For such service small sub-collectors' fees were paid.

# SPECIAL ARRANGEMENTS FOR ENUMERATION OF TRAVELLERS.

Travellers on Trains.—So far as Tasmania was concerned, no trains were on the lines during the specified Census hours; all arrangements for enumerating were made, had there been any.

Travellers on Ships.—Cards were left on all vessels leaving Tasmania and collected on arrival, as per instruction 46 to enumerators, and collectors' instructions 45, 46, etc.

Some little trouble was caused to the Hobart shipping collector owing to a misunderstanding in regard to vessels leaving other States after Census night without leaving cards. In each case the collection was satisfactorily made, and cards forwarded to proper destination.

## POLICE.

Only in isolated cases were the services of police officers used. Any fees paid those officers appointed collectors being paid into the Police Provident Fund.

# INTERPRETERS.

There is no record of the services of any interpreters having been necessary.

#### VESSELS IN PORT.

As per instructions quoted above (Shipping).

# DESPATCH OF CENSUS MATERIALS TO COLLECTORS.—DISTRIBUTION AND COLLECTION.

Table dealing with these features is attached hereto:—

Census D	istrict.	Range of time ac Collectors in diffe		Despatch and completion of Census Materials.		
Name.		Shortest.	Longest.	Despatched.	·Completed	
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(Signed) R M JOHNSTON,
State Supervisor of Census, Tasmania.

15th July, 1911<sub>4</sub>

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# APPENDIX A.

VOL. I.

# CENSUS OF THE COMMONWEALTH OF AUSTRALIA.

The Mathematical Theory of Population, of its Character and Fluctuations, and of the Factors which influence them,

BEING AN

Examination of the general scheme of Statistical Representation, with deductions of necessary formulae; the whole being applied to the data of the Australian Census of 1911, and to the elucidation of Australian Population Statistics generally.

BY

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## COMMONWEALTH STATISTICIAN.

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# FOREWORD.

The following monograph on the Mathematical Theory of Population, in form an appendix to the Report on the Australian Census of 1911, is intended to serve a double purpose. It aims on the one hand at supplying the elements of a mathematical technique, such as are needed for the analysis of the various aspects of vital phenomena that come under statistical review, and, on the other, at interpreting material made available by the first Census of Australia which has been carried out upon uniform lines and by a central authority. The earlier portion of the appendix has consequently been almost wholly devoted to the creation of the requisite technique. Later technical solutions are introduced only when required by way of application to any statistical analysis under immediate review.

In the realm of official statistics there is an enormous amount of accumulated material, which, decade after decade, remains unanalysed and uninterpreted. This is due to several things, viz., to the fact that routine tabulations largely occupy the energies of the staffs of statistical bureaux; to the fact that much of the mass of material itself is defective and its correction involves more time than is available; and perhaps still more to the fact that appropriate schemes of mathematical analysis have as yet either not been developed, or are regarded as inapplicable.

The present analyses and interpretations have yielded many results which, it is believed, will be seen to be of value. They have brought into clearer relief the necessity for recognising that the variation of any one statistical element affects all other statistical elements, so that the satisfactory reduction of "crude data" to a common system is by no means an easy undertaking, and the comparability of the statistic of two communities can never be rigorously exact in all particulars. It is fortunate, however, that practically exactitude means merely "a precision sufficient for any particular purpose in view."

In substance this monograph consists of two elements, viz., (i.) a technical one, and (ii.) an interpretative one. Formulæ essential for the purposes of interpretation have been deduced, and their use has been illustrated by application to the data of the Australian Censuses, or to intercensal statistical data which, subject otherwise to considerable uncertainty, could be adjusted only by means of information derived from the Census. Thus results of immediate value are obtained simultaneously with an exposition of the theory and technique of the subject.

The various formulæ developed have been carefully checked throughout, but it is too much to hope that among so many results error has been completely avoided. The author will, therefore, be grateful if any discoverer of errors or misprints will communicate with him.

As a rule corrections to data have been pushed as far as seemed to be desirable; theoretically it is often possible to push them even still farther. It is doubted, however, whether the precision of the data would justify this. An example will illustrate the point. In determining the ratios which reveal the age of maximum fecundity, if the number of women at risk be taken as the total of the same age-group, the denominator will be too large and the derived ratio too small. Hence allowances must be made for the diminution of risk for prior cases of child-birth. But there is no well-defined time-limit at which these allowances should stop. In general, however, their applicability becomes more questionable as they become smaller.

A synopsis shews the general treatment of the subject, and an index, at the end of this appendix, makes reference thereto easy. Where it has been deemed necessary to coin technical expressions their derivation has been indicated.

Finally it may be mentioned that many of the formulæ developed will be found serviceable in other investigations in which statistical methods are called into requisition.

G. H. KNIBBS.

Commonwealth Bureau of Census and Statistics.

Melbourne, March 1917.

# CORRIGENDA.

- Page 3.-Under figures in footnote: after "small figures" read "in brackets."
- Page 4.- § 4, line 8: for "an" read "on."
- Page 7.—Line 3; for "acurately" read "accurately."

  Line 3, footnote, for "Gesellschaftsehre" read "Gesellschaftslehre,"
- Page 8.—Sub-heading (iv.). For "interpolation" read "interpolations." Line 7, last paragraph, insert "the" after "given."
- Page 40.—Line 11 from bottom, after log x, insert "and  $\kappa$  being log k."

  Line 9 from bottom, for "k," "2k," "3k," read " $\kappa$ ," " $2\kappa$ ," " $3\kappa$ ."
- Page 55.-Line I, for " of a curve" read " of the curve."
- Page 68.—Formula (197d), for (" 1—' read " (i—.''

  Line 13, after " above" add " the numerical coefficients remaining, of course, the same."
- Page 72.—In formula (211), the y should follow the sign of integration.
- Page 81.—Line 4 from bottom, for (" n" read (" h."
- Page 104.—Line 5, for "difference" read "the differences."

  Line 27, for "the comparison of" read "comparisons among."
- Page 144.—Lines 10 and 11, for "section" and "sections," read "Part" and "Parts," and for XII., read XI.
- Page 163.—Line 4, for "M" read "M."

  Line 7, for "2Mr + " read "2Mr."
- Page 213.—Line 3 from bottom, for "occupying" read "occurring."
- Page 233.—Line 4 of paragraph, for "in part of the" read "in part the."
- Page 240.—Line 4, § 8, add after "maternity," "each birth being regarded a case of maternity."
- Page 242.—Throughout table read "births" for "maternity."
- Page 277.—Table LXXXVIII., in "Duration," for 251-160, read "251-260," and for "251-170" read "261-270."
- Page 306.—Add to end of paragraph:—"Twins produced from one ovum have been called 'univitellins' and those from two ova 'bivitellins'."
- Page 307.—Line 3 from bottom, for "uniovulate" read "uniovular."
- Note. Formulæ 374, and 396 are omitted.

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## SYNOPSIS.

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#### APPENDIX A.

# THE MATHEMATICAL THEORY OF POPULATION, OF ITS CHARACTER AND FLUCTUATIONS, AND OF THE FACTORS WHICH INFLUENCE THEM.

#### I.-INTRODUCTORY.

1. General.—The fundamental elements of social statistics are the fluctuations of the numbers and constitution of the population and of its various characteristics. These fluctuations are profoundly affected by many factors, only some of which are susceptible of physical expression. For example, the extraordinary development, characteristic in the last few decades, of every branch of science and technology, and the skill with which acquired knowledge has been applied to the exploitation of Nature's resources, have probably created the possibility of developing a considerably larger population than the world has yet carried, at least in historic times. On the other hand, the social standards have been so profoundly altered as to strongly counteract the effect indicated. Thus the raising of the standard of living, and an increased complexity in social organisation have held in check, more or less, that increase of population which might otherwise have been possible.

The opposition of tendency involved by the coëxistence of these two factors necessarily reinforces the interest, while it increases the difficulty of the problems which depend for solution on an evaluation of the degree of influence exerted by particular factors. The interest of any theory is evident when we ask: "What, on the whole, is indicated by past statistical history as to the future populations of the various races of the world?" This is a question, the correct answer to which is a necessary guide for national policy, and one which involves not only the accumulation of statistical facts that have now become available, but also a theory by means of which a forecast can be made as to what the immediate future has in store for each community.

An interesting illustration of this may be drawn from the history of the United States. In the year 1815, Elkanah Watson predicted with extraordinary accuracy the population of the United States up to the year 1860, by some method which, though not absolutely doing so, was sensibly equivalent to simply assuming a constant rate of increase. As a matter of fact, had Watson actually assumed that the rate of increase from 1790 to 1800 would remain constant till 1860, he would have predicted the population with still greater accuracy than he actually did. This will be made apparent hereinafter: see also Figs. 3 and 4.

The more complex conditions of the world to-day and the rapidity of the development of the arts and sciences, make the accuracy of prediction for so lengthy a period extremely doubtful; nevertheless an attempt to forecast the affairs of any country, to be well founded, must be based upon the results of a review, among other things, of all the facts of its population development, and upon a study of this development in all other parts of the world.

Of no less interest is the constitution of a population in respect of age, sex and race, and the influence of birth-rates and death-rates thereupon. The effect of age at marriage, the reproductivity as measured by frequency of childbirth, and the age at which it occurs, the probability of living at every age, and the variation of this probability with increasing scientific, hygienic and economic knowledge, are problems of the first order of importance.

The attempt is here made to give a rough outline of the theory of the subject, elucidating that theory where it seemed desirable by quantitative examples.

2. Significance of analysis.—The fluctuations in the number and constitution and other characters of populations present, in general, complex and dissimilar changes, and depend upon elements which will not readily lend themselves to prediction. They would thus appear at first sight not to be amenable to mathematical analysis. Nevertheless, when the fluctuations are analysed and expressed in mathematical form, their trend often becomes much more definite, and their true significance is more clearly revealed. <sup>1</sup>

<sup>&</sup>lt;sup>1</sup> An example will illustrate what is meant. The populations in the United States in 1790 and 1820 were respectively 3.93 and 9.64 millions of people. If the number were supposed to increase at each instance at a uniform rate so as to give these numbers in the years mentioned, the deduced populations would be very nearly the actual ones, not only for the intermediate decades, but even up to the year 1860, as is evident from the following table, viz:—

Year	1790	1800	1810	1820	1830	1840	1850	1860
Population supposed to increase at uni- form rate (millions)	3.93	5.30	7.15	9.64	13.00	17.53	23.65	31.89
Actual population (millions) Difference (millions)	3.93 .00	5.31 .01	7.24 .09	9.64	12.87 .13	17.07 .46	23.19 .46	31.44 .45

A remarkable prediction by Elkanah Watson is referred to later: see Figs. 3 and 4.

This fact, viz., that the supposition made is approximately true, throws light on the other facts. Thus, that to accord with this supposition the figures for 1800 and 1810 are very slightly too small, while those for 1830 to 1860 are somewhat in excess; and the excess is constant for 1840, 1850, and 1860; illustrate the value of the scheme of analysis by means of which the fundamental idea is ascertained. The deviations of the actual values from those computed on the assumption of uniform rate of increase may thus, indeed, become in turn the starting point of a further analysis undertaken with a view to the interpretation of the departure from the law of uniform increase, arbitrarily adopted as the norm of the phenomena.

For this reason it is proposed to develop the mathematical conceptions which may serve as the foundation of definite analyses of the fluctuation of any population; to express these conceptions by formulæ; to so develop and resolve the formulæ that they may be readily applied; and, where necessary, to illustrate their application.

3. The nature of the problem.—An ideal theory of population is one which would enable the statistician not only to determine definitely the influences thereupon of the various elements of human development, and of the phenomena of Nature, but also to examine all facts of interest to mankind, as they stand in relation to population. And however hopeless may be the expectations of establishing such a theory with meticulous precision and in all detail, it nevertheless remains true that fluctuations of population can often be adequately understood only when they are analysed by means of definite mathematical conceptions. Moreover, since all important facts concerning population are susceptible of numerical expression, analytical conceptions formulated for the purpose of giving exactitude to a knowledge of its variations, should be ultimately cast, if possible, in a mathematical mould. <sup>1</sup>

The total population-aggregates of some countries have been found to increase almost exactly at a uniform rate; in general, however, the rate fluctuates. "Can the characteristics of such fluctuations be subsumed under any conception?" is a question which naturally presents itself.

$$3,930,000$$
;  $(+1,370,173) = 5,300,173$ ;  $(+1,847,877) = 7,148,050$ ;  $(+2,402,128) = 9,640,178$ .

The differences, shewn by the small figures, do not in themselves disclose the fact that the increase is at a uniform rate, but on dividing each by the preceding population figures it is seen to be equivalent to adding 348,644 persons per million per decennium. Hence, obviously, the rate of increase was constant. This rate will be found to be equal to an increase of 30,361.8 annually per million of the population at the beginning of each year.

The facts just indicated, viz., that starting with a population of 3,930,000, and uniform increases at the rate of 0.02991 per annum, gives a population of 5,300,173 in ten years, etc.; that an equivalent figure is given for the population if, at the end of each year, there is added to it an absolute increment of the amount of 0.0303618 of the population at its beginning; that the figures at the end of a decennium are given by adding an increment of 0.348644 of the population at the beginning of the decennium—can be elucidated only by formulating a definite conception of rate, and studying the consequences that flow therefrom. It is, for example, by no means immediately obvious that, used with the limitations above indicated, the three sets of figures will give identical results. The last will accurately give only decennial results; the middle value only annual; the rate of continuous increase is the only one which is appropriate to furnish correct results for any moment during the whole period under review: see Fig. 4.

<sup>&</sup>lt;sup>1</sup> To revert to a previous illustration, for example, if we ask: "What uniform rate of increase would cause a population of 3.93 millions to become 9.64 millions in 30 years?" the answer is that it would be necessary that each million persons should receive at each instant an addition at the rate of 29,910 persons per annum, that is to say, the rate of continuous increase would have to be 0.02991 per annum. More exactly, this would give the following figures, viz.:—

Such answer as may be given must, if it is to be explicit, obviously be in the form of a mathematical theory of the subject. Such a theory will be found to involve two elements, viz.:—

- (a) The appropriation of suitable conceptions of a mathematical
- . character, and
- (b) The development of a scheme of using them.

The propriety of the application of such conceptions is to be measured by the extent to which they are capable of illuminating the actual facts, and of reducing them to system.

What has been said regarding total population, applies equally to each constituent part, viz., to the totals for each sex, to the number of both sexes or of either sex at birth or at a particular age, to the ratio of the sexes, to the fluctuations in the rates of birth or death, and to all the circumstances of migration.

In other words, any fact, either of the condition or constitution of population at any moment, or of the relation of these at different moments can be readily subsumed under appropriate mathematical conceptions with sufficient precision for practical purposes.

Again, in dealing with the co-ordination of population with other related facts susceptible of statistical statement, the question often arises: "How can the nature of the relation be best defined or best disclosed?" The selection of appropriate mathematical conceptions, and the means of bringing the facts under them, also constitute phases of the theory to be considered.

4. Necessity for the mathematical expression of the conditions of the problem.—Although, in the nature of the case, the population of any territory necessarily changes through births and deaths by whole units, and in instances of immigration and emigration sometimes by relatively large groups of units, no appreciable error will ordinarily be committed, at least where the aggregate population is large, if all its fluctuations be supposed to take place continuously and by infinitesimal increments. This supposition, which might appear an insufficient consideration to be physically invalid, very fairly represents, after all, the actual facts in their totality.

<sup>&</sup>lt;sup>1</sup> For, when all the circumstances are taken into account, it is obvious that the extent or degree to which the individuals of a community participate in its economic and general life, or in territorial occupation, passes through a wide range of values. These considerations have application even to the circumstances of birth and death, and even moreover to those of immigration and emigration. The ordinary involvement of a community by each individual through the circumstances preceding birth and following upon death, shew clearly that in many important respects the introduction and disappearance of a unit of the population is, virtually, not quite instantaneous.

It is obvious, too, that this consideration would apply even if registration, or rather the statistical recognition of that fact, were contemporaneous with birth and death, which, however, it is not, since ordinarily it follows these events by a period of varying length. In cases of birth it also stretches over a longer period. It

Thus the fluctuations of population therein may at least in ordinary cases, be represented with precision by an *imaginary* or *fictitious population*, the ideal fluctuations of which, varying with time, conform to all the laws of infinitesimal increment or decrement, in this way rendering those fluctuations amenable to a rigorous analysis by the methods of the infinitesimal calculus. Such an imaginary population, changing continually by infinitesimal amounts, not only accurately represents the totality of facts, but is amenable to mathematical treatment.

It is nevertheless important to bear in mind that actual populationchanges may be oscillatory, as will later be shewn.

5. Conception applies equally to a population "de facto" or a population "de jure."—Population may be related to territory in two ways, viz., by actual presence, and by legal relationship therewith; that is to say, the relationship may be "de facto" or "de jure"; and official statements regarding population are of each kind. In some countries, as where the floating population is large, or where citizens are under special obligations (e.g., military service, etc.), the main concern may be to ascertain the population which may be said to belong to, or to be domiciled in the place, the foreign migratory element, whatever its magnitude, being regarded as of relatively little moment. Again, where communal rights are explicit and of an important character, the general reasons for deciding to adopt the "de jure" relationship for the official enumeration of population may be very cogent. 1

The association of a human being, however, with any particular territory, delimited by frontiers of any type whatever, is, after all, only one of degree, so that any criterion (e.g., nationality, domicile, etc.), other than that of mere presence in the territory, however necessary for certain purposes, is more or less indeterminate for others, particularly in countries where the freedom of movement of the individual is practically unrestricted. The actual presence of an individual in any territory involves, in varying degree, <sup>2</sup> the whole scheme of general relationship which every unit has to the general community in which he finds himself, and which that community has to the territory it is occupying. He is

is considerably influenced by legal prescriptions in regard thereto, as well as by the traditions and circumstances of the community. Thus the registration of death must perforce quickly follow on its occurrence; not so the registration of birth. In a sparsely populated district, the registration of birth may be very late as compared with registration in a densely-populated area.

We may remark in passing, that official estimates of population, at least when based upon accurate vital and migration records, as ordinarily kept and reported, are usually slightly in error as regards actual populations, viz., to an extent corresponding to the want of balance between inclusions at the beginning of a period of record, really belonging to a previous record, and exclusions at the end of the period owing to complete information not being to hand. In an increasing population the error tends on the whole to be one of defect.

<sup>&</sup>lt;sup>1</sup> As, for example, in some of the Cantons in Switzerland.

<sup>&</sup>lt;sup>2</sup> The economics and general relationship of individual with a community passes through a wide range of values, and in each individual the value varies with his age.

subject to the laws and to the same extent also the general civic and other responsibilities of the place, while the community, on the other hand, is concerned with his protection and well-being. Hence the "de facto" population may often be statistical desideratum. For other purposes obviously the "de jure" population is a necessity.

For the general purposes of economics there are features characteristic of population which may be considered either in the "de jure" or the "de facto" relationship, which may call for specialisation in any mathematical treatment. For mere enumeration, however, the mathematical conception as above defined will apply with equal rigour to either.

6. Nature of population fluctuations.—The fluctuations of the entire population of the earth, if available for long periods, would probably disclose in their most general aspect the secular characteristics of its increase, which must have greatly varied. Merely local effects would to a large extent disappear in the total; opposite periodicities, dependent on seasons, would be balanced by the inclusion of results from both hemispheres; by taking quinquennial, decennial, or longer means or averages, the effect of minor fluctuations would be correspondingly eliminated; and the broad outlines of the facts of the growth of the world's population would be brought into relief. Were the curve of secular increase of population for the entire earth available, it would obviously constitute the most suitable norm for general comparative purposes. Statistic unfortunately, has, however, not yet attained to All we can assert with certainity is that the present rate of increase can have existed for a relatively short time only.

Limiting the consideration to particular countries, changes will be found exhibiting the following features, viz.:—

- (i.) The rate of appearance of individuals by birth, and disappearance by death is not, in general, uniform throughout the year, but shews more or less definitely an annual period.
- (ii.) The movement of floating population is also non-uniform, disclosing, in many instances, definite annual periodicity.
- (iii.) Improvements of natural conditions are in general followed by changed rate of increment to the population, which may have a period of a considerable number of years, or may be brief.
- (iv.) Variations of social and economic traditions profoundly affect the rate of increase of population.

For the larger purposes of statistic, elements of the type (i.) and (ii.) are ordinarily negligible; while those of the type (iii.) and (iv.) are of the first order of importance. For minor purposes the converse may be true. Hence, the scheme of any investigation must be adapted to the element under consideration.

In general, secular and long-period changes must be eliminated in order to accurately study minor and short-period changes; and conversely, minor periodic changes must be eliminated in order to acurately ascertain the characteristics of the secular changes.

- 7. Changes in the constitution of populations.—The ratio of the total numbers of each sex, the proportion of the sexes at each age, the relative birth, marriage, and death rates, the circumstances affecting fecundity, the consequences upon all of these of migration, of disease, of war, and of economic and social traditions and developments, as well as their fluctuations with the lapse of time, are necessarily matters of statistical concern. Such changes may be called "constitutive changes," or perhaps "organic changes," and their analysis and subsumption under mathematical expressions are often of importance and are essential in various statistical analyses.
- 8. Organic adjustments of populations.—In reviewing the constitution of population as a whole, it is obvious that organic adjustments occur.<sup>1</sup>

The nature and drift of such adjustment as has been indicated, or of the deviations of the actual constitution of a population at any moment from some norm adopted for comparison, and the changes in such deviations, can be effectively studied only by the establishment of a system of suitable mathematical relations. For such deviations to be made the subject of prediction, the law of their fluctuation with time, must, of course, be ascertained. The principles guiding the constitution of a norm will be illustrated hereinafter.

9. Continuous and finite fluctuations.—The scope of the mathematical theory of the fluctuation of population reveals its fundamental importance. Every form of fluctuation, whether of total population, or of its constitutive elements, of its characters, or of the influences to which these are subject, may ordinarily be regarded as changing continuously by infinitesimal increments or decrements within the period during which it is assumed to vary. In special cases the fluctuations may even be discontinuous.

¹ In Europe, for example, of those born living, there are about 105 male births to every 100 female births: of those still-born the proportion is about 133 (see "Die Geborenen nach dem Geschlecht," in "Statistik und Gesellschaftschre," by Prof. Dr. Georg von Mayr. Bd. II., § 56, p. 189), and the deviation from these figures for different countries is, in general, small. Nevertheless, in the total population of Europe there is a ratio of only about 97.6 males to 100 females. To war and unhealthy occupation, and accident, the death of a considerable number of males is directly attributed. Thus there are no less than about 108 deaths of males to 100 deaths of females, for a number of countries. Nevertheless, because of the larger number of male births, the percentage does not materially change.

The aim of any definitive consideration of the subject is to express the fluctuations of population or of its constituent elements, and of its characters, in forms which will serve—

- (i.) To render intelligible the characteristics of such fluctuations.
- (ii.) To assist attempts at tracing the cause and effect of fluctuations.
- (iii.) To determine means and averages, etc.
- (iv.) To make all required interpolation of values.
- (v.) To make prediction by extrapolation possible, or to make it possible by the result of a general analysis.
- (vi.) To bring into clear relief the various characters of a population.
- 10. Curves required to represent various fluctuations and the solution of the same. When a curve or "graph" representing a series of statistical results can be defined with sufficient accuracy by some form which is susceptible of geometrical or algebraical representation, such definition constitutes an advance as regards the understanding of the essential nature of the facts: a clearer conception of the statistical results is attained. For example, if the rate at which a population is growing be constant, then the curve passing through the terminals of the ordinates (whose length represents the successive values of the population) plotted against distances along an axis representing time, is a curve which is concave upward. This curve is of character such that, if, instead of plotting the ordinates on the natural scale, their logarithms be plotted, the terminals will be found to lie upon a straight line. Thus, if when the logarithms of the numbers of any population at different dates are plotted as ordinates, and the times as abscissæ, the points are found to lie on a straight line, we know that the rate of increase is constant.

To thoroughly represent and to analyse the nature of the changes in the size of any population or the changes in its constituent elements or characters, a considerable command of schemes of curve-representation is a desideratum. For the mathematical representation of fluctuation, therefore, it is, in general, necessary to know the geometrical form or graph of various algebraic or other mathematical expressions; in order that, given geometrical form or graph of a series of results, the mathematical expression appropriate to represent it will be recognised. For this reason a considerable number of type-curves and a knowledge of their graphs must be at the disposal of the statistical analyst, so that the appropriate expression may be selected. As soon as it is decided upon, the mode of solving for the constants of the representative expression becomes of importance. With this in view, it has been found desirable to give a considerable number of formulæ, and to indicate the methods by means of which the constants that make the expression definitive can be found.

This has been the more necessary, because, after all, the scheme of statistical representation, or the "fitting of curves," is an art of much difficulty, and one which is only in its infancy.

The fluctuations of the numbers representing population and its various characters make considerable demands in regard to knowledge of this kind, and consequently not only are formulæ given herein from time to time, but their "graphs" are also drawn. These exhibit the character of the curves represented. It will be seen that the interpretation of statistical results therefore make considerable demands of what is called curve-tracing.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> The "Spezielle algebraische und transzendente ebene Kurven, Theorie und Geschichte," of Dr. Gino Loria, 2 vols., Teubner, Leipzig, 1910-1911; the "Sammlung von Formeln der reinen und angewandten Mathematik," by Dr. W. Laska, Fr. Vieweg und Sohn, Braunschweig, 1888-1894; and Frost's well-known "Curve Tracing," give much valuable information in regard to the possibility of representing certain important forms. These works, however, are neither adequate nor exhaustive. The work of Felix Auerbach on "Physik in graphischen Darstellungen," Teubner, Leipzig, 1912, has also a large number of forms of importance to statisticians.

#### II.—VARIOUS TYPES OF POPULATION FLUCTUATIONS.

1. Mathematical conception of rate of increase.—Whether diminishing or gaining, any actual population may be replaced by a "representative population," assumed to change at every moment by infinitesimal amounts at some rate ( $\rho$  say) per unit of time. That is to say,  $\rho$  will denote the fraction of a unit which, at the instant under consideration, measures the rate of change of the population for a unit of time. Hence, if  $P_t$  be the population at the time t, and  $P_{t+\delta t}$  that at the time  $t + \delta t$ , then where  $\delta t$  is small we shall have

$$(1) \dots P_{t+\delta t} = P_t (1 + \rho \delta t) = P_t e^{\rho \delta t}$$

as the fundamental expression for its fluctuation. In other words- $P_t \rho \delta t$  is the absolute change in the time  $\delta t$ . If  $\rho$  be positive, the change is an increase; if negative, it is a decrease.

The rate  $\rho$  may be either constant, in which case we shall denote it by r, or it may on the other hand vary in some determinate way with time, in which case we shall retain the Greek letter. If the rate be regarded as a function of time, then we should have

$$(1 \mathrm{a}) \ldots P_{t+\delta t} = P_t \{ 
ho \, (1+\phi t) \, dt \}$$
 We shall consider initially the case where it is constant.

2. Determination of a population for any instant when the rate is If increments of population be supposed to be added at N uniform intervals of time, extending over the period t, at the uniform rate r per unit of population per unit of time, then, putting  $P_{\mathfrak{o}}$  for the initial population and  $P_t$  for that at the end of the time t, we shall have,

$$(2)....P_{t} = P_{0} \left(1 + \frac{r}{N}\right)^{Nt}; = P_{0} e^{rt}$$

when N becomes finite.

As usual e denotes the base of Napierian logarithms, viz.:-2.7182818284590, etc.

It is sometimes convenient to put this expression in the form of a series: thus, by the exponential theorem, we have

(2a).....
$$P_t = P_0 \left(1 + rt + \frac{r^2t^2}{2!} + \frac{r^3t^3}{3!} + \text{etc.}\right)$$

Taking logarithms of both sides of (2), we notice that

<sup>&</sup>lt;sup>1</sup> When  $\rho$  is constant the investigation is analogous to that for determining the increase in a sum of money when interest is supposed to accrue at every instant of time. For a development of the theory of continuous interest and a kindred investigation of population, see a paper by J. M. Allen, Journ. Inst. Actuaries, Vol. XLI., p. 305.

$$(3).....\log P_t = \log P_0 + (r \log e) t$$

The value of  $\log_{10} e$  is 0.4342944819032, etc., and of  $\log_{10} (\log_{10} e)$  is 9.6377843113005, etc.<sup>2</sup> Both are required in practical calculation, to, however, only few places of decimals.

To find the constant rate of increase, we have

$$(4)....r = (\log P_t - \log P_0) / (t \log e)$$

3. Relation of instantaneous rate to the ratio of increase for various periods.—We may call the constant r the constant rate of continuous increase, and similarly the variable  $\rho$  the instantaneous rate of continuous increase. It is often necessary, however, to substitute for r the equivalent rate for a year, or for five or ten years, that is to say, to measure the ratio at which the population at the beginning of the period must be increased in order to give it its proper value at the end thereof. Calling this  $r_t$ , we have

$$(5)$$
..... $r_t = (P_t - P_0) / P_0 = e^{rt} - 1$ ; or  $e^{rt} = 1 + r_t$ 

4. Determination of the mean population for any period: rate constant.—Let  $P_0$  denote the population at the beginning of any period and  $P_t$  the population after the time t: then, since  $\int e^{rt} dt = e^{rt}/r$ , the mean population  $P_{\rm m}$  is obviously

(6)... 
$$\frac{1}{t} \int_{0}^{t} P_{t} dt = \frac{P_{0}}{t} \int_{0}^{t} e^{rt} dt = \frac{P_{0}(e^{rt}-1)}{rt} = P_{0}(1+\frac{rt}{2!}+\frac{r^{2}t^{2}}{3!}+\text{etc.})$$

a formula which is suitable for determining the mean from the initial population. This expression may be put also in the form, see (5)

$$(7)$$
.... $(P_t - P_0) / rt$ ; or  $P_0 P_t / rt$ 

by means of which, when the rate is constant and known, the mean population can be calculated, either from the absolute increase for a given period, or from the ratio of the increase for a given period to the initial population for that period.

 $<sup>^{1}</sup>$  Partial, because the values of t and not of the logarithms of t are not used as the abscissæ.

<sup>2 9</sup> is used instead of T.

5. Error of the arithmetical mean: rate constant.—The arithmetical mean of the population at the beginning and end of any finite period differs, of course, from the true mean. The magnitude of this difference is sometimes required. From (2a) and (6) we obtain-

(8).....
$$P_{\rm m} = \frac{1}{2} (P_0 + P_t) - P_0 \left( \frac{r^2 t^2}{2.3!} + \frac{2r^3 t^3}{2.4!} + \frac{3r^4 t^4}{2.5!} + \text{ etc.} \right)$$

which may also be written-

(8a).....
$$P_{\rm m} = \frac{1}{2} (P_0 + P_t) - P_t \left( \frac{r^2 t^2}{2.3!} - \frac{2r^3 t^3}{2.4!} + \frac{3r^4 t^4}{2.5!} - \text{etc.} \right)$$

When expressed in terms of the arithmetical mean itself, the odd powers of r and t disappear, thus

(8b).....
$$P_m = \frac{1}{2} (P_0 + P_t) \left( 1 - \frac{r^2 t^2}{2 \cdot 3!} + \frac{2r^4 t^4}{2 \cdot 5!} - \frac{17r^6 t^6}{2^2 \cdot 7!} - \text{etc.} \right)$$

This last is the most convenient formula. The values of the coefficients are  $\frac{1}{12}$ ,  $\frac{1}{120}$ ,  $\frac{17}{20180}$ , etc.

Remembering that the maximum value of r is about 0.03, all these series converge with sufficient rapidity.

6. Empirical expression for any population-fluctuation.—If the population of a country be determined at n + 1 different dates, then a curve of the nth degree can be arbitrarily drawn, passing through the graph of the coordinates. In the absence of any information as to the magnitude of the population between the given dates, the ordinate to the curve drawn from the terminal of the abscissa corresponding to the date may be assumed to be a probable value for the population at that date.

The curve in question may be written 1-

$$(9)....P_t = P_0 (1 + at + bt^2 + ct^3 + \text{etc.})$$

which, for purposes of practical calculations or computational check, may be found convenient in the form :-

$$(9a)...P_t = P_0 \{1 + t [a + t (b + tc + etc.)]\}$$

7. Mean population for any period: rate not constant.—Using the same notation as in II., 4, equation (6), we have-

$$(10) \dots P_{m} = \frac{1}{t_{2} - t_{1}} \int_{t_{1}}^{t_{2}} P_{t} dt =$$

$$P_{0} \left\{ 1 + \frac{a}{2} (t_{2} + t_{1}) + \frac{b}{3} (t_{2}^{2} + t_{2}t_{1} + t_{1}^{2}) + \frac{c}{4} (t_{2}^{3} + t_{2}^{2}t_{1} + t_{2}t_{1}^{2} + t_{1}^{3}) + \text{etc.} \right\}$$

Since, in the majority of calculations,  $t_1$  is 0, in which case  $t_2$  becomes simply t, we may write the result thus:-

(10a)....
$$P_{\rm m}=P_0\left(1+\frac{1}{2}\,at+\frac{1}{3}\,bt^2+\frac{1}{4}\,ct^3+{
m etc.}\right)$$
; or 
$$P_0\left\{1+t\left[\frac{a}{2}+t\left(\frac{b}{3}+t\frac{c}{4}+{
m etc.}\right)\right]\right\}$$
 the latter form being sometimes the more convenient for practical cal-

culation.

<sup>&</sup>lt;sup>1</sup> See equation (45a) hereinafter. The fitting-efficiency of equation (9) is not equal to that indicated later, but it is more convenient to use

8. Change, with change of epoch, of the coefficients expressing rate.—If the coefficients a, b, etc., have been determined for  $P_0$  at a particular date, and it be desired to make the population,  $P_t$  the origin  $P_0$  for new computations, so that—

(11) 
$$P'_{\tau} = P'_{0} (1 + a\tau + \beta\tau^{2} + \gamma\tau^{3} + \text{etc.})$$

in which  $\tau$  denotes the interval of time after the new epoch ; that is to say,  $P'_{\tau}=P_{t+\tau}$  and  $P'_{0}=P_{t}$ 

On putting  $P_t / P_0 = 1 + r'$ , we shall then have

(12)..... 
$$\begin{cases} a = (a + 2bt + 3 ct^2 + 4 dt^3 + \text{etc.})/(1 + r') \\ \beta = (b + 3 ct + 6 dt^2 + \text{etc.})/(1 + r') \\ \gamma = (c + 4dt + \text{etc.})/(1 + r') \end{cases}$$

which is perhaps the best form for computation. If the quantity enclosed in brackets in equation (9) be denoted by  $y = \phi t$ , the several quantities in the brackets in (12) are dy/dt;  $(d^2y/dt^2)/2!$ ;  $(d^3y/dt^3)/3!$ ; etc., and the coefficients can be written out by a reference to Pascal's triangle. They are, of course, simple "figurate numbers" of the second, third, fourth, etc., orders.

That the coefficients must be altered when a new origin for t is selected, exposes one of the inherent limitations of the empirical equation.

9. Error of the arithmetical mean: rate not constant.—The arithmetical mean will always be in excess with either a uniform or a growing rate of increase. From (9) and (10a) we obtain—

(13).....
$$P_{\rm m} = \frac{1}{2} (P_0 + P_t) - P_0 \left( \frac{bt^2}{2.3} + \frac{2ct^3}{2.4} + \frac{3dt^4}{2.5} + \text{etc.} \right)$$

which may also be readily expressed in terms of the mean itself, as in (8b), thus-

$$(13a)...P_{\rm m} = \frac{1}{2}(P_0 + P_t) \left\{1 - \frac{b}{3!}t^2 + \frac{2ab - 6c}{4!}t^3 - \frac{5a^2b - 10b^2 - 15ac - 36d}{5!}t^4 - {\rm etc.}\right\}$$

This, however, is more tedious to use than (13).

10. Expression of the coefficients in the empirical formula for rate in terms of the constant rate.—If in equation (9), viz.:—

$$P_t = P_0 (1 + at + bt^2 + ct^3 + \text{etc.})$$
  
 $a = r; b = r^2/2!; c = r^3/3!; \text{etc.}$ 

the equation would express a constant rate, that is to say, it would be simply another form of equation (2a); and if a, b, c, etc., have not these values, the rate of increase is variable.

By substituting the corresponding values of r in (13a), it may easily be seen to be identical with (8b); and similarly as regards (13) and (8).

11. Investigation of rate is complete only when its variations are ascertained.—Reverting to II., 1, equation (1) may be written—

$$(14)....\delta P = P\rho \delta t = P\phi(t)\delta t$$

which may be regarded as the fundamental differential form for increase of population, the final form being required, since the rate  $\rho$  is rarely if ever, constant, even for short periods of time. Hence in its theoretical form, an investigation of the fluctuations of population cannot be complete till all variations of its rate of growth are definitively ascertained, in other words,  $\phi(t)$  must be ascertained.

- 12. Rate is a function of elements that vary with time.—The rate at which population increases is dependent upon elements external to and beyond the control of man, as well as upon elements within him, more or less under control. Both change with the lapse of time. In Fig. 3, § 32, hereinafter, examples are given shewing the curve of population of different countries, and in Fig. 4, of the same section, the corresponding logarithmic homologues of the populations. As already pointed out, the latter would be straight lines, if the rates of increase were constant. Hence, in the sense that it is dependent upon elements that vary with time, and may thus be directly related to the latter, the rate  $\rho = \phi(t)$  may be investigated as a function of the elapsed time.
- 13. Factors which secularly influence the rate of increase.—Where not otherwise expressed, the rate of increase will be assumed to refer to total population. Let us consider primarily a community which grows by natural increase alone. This increase will be profoundly affected by four types of things, viz.:—
  - (i.) The material natural resources of the occupied territory.
  - (ii.) The various cosmic energies which facilitate man's development.
  - (iii.) Knowledge which increases the power of utilising natural resources.
  - (iv.) Sociological and other analogous standards, which react upon human activities, particularly upon man's productiveness, and the magnitude and character of his consumption of what he has produced.

Regarding (i.), it may be said that the natural resources of the territory occupied may be either actual or potential. Even without human intervention, a territory may be prodigal of those forms of animal and vegetable life, for example, which provide immediately for human wants. Its climate and meteorology may be propitious. It may possess large stores of readily available wealth, or of energy convertible into wealth.

Or yet, again, though in the state of Nature infertile, it may respond to well-directed efforts to make it so. It may have large hidden resources which can be recognised, and can become available only through a considerable development of scientific and technical knowledge, and through practical ability in applying the same. Lastly, it may contain types of wealth, as for example mineral wealth generally, which, though valueless per se to sustain life, may be made contributory to the growth of population through the part they play in the world-economy.

All these may be summed up under two headings, viz.:-

- (i.) Natural fertility and resources of the territory independent of human action.
- (ii.) Wealth or resources dependent on human action.

Both, however, are potentialities rather than actualities in regard to population: how they eventuate in respect thereto depends upon other and very subtle factors inhering in that order of things which concerns the general sociological and economic beliefs and in the traditions and activities of the people. For example, the general attitude of a people in respect to the question of fecundity and the prevailing view as to what should constitute a reasonable standard of living, profoundly affect the rapidity of the increase of the population, and the reaching of the time when natural limitations of fecundity operate severely.

There is still another factor of an analogous nature that plays a part, the significance of which is each year becoming more manifest, viz.:— The attitude of a people toward the development of the intellectual powers of man, and toward the application of such powers to the availment of the resources of Nature. Indeed, in general, the great advantages of the human being over the larger mammals is due to the efficiency in this direction of his intellectual endowment, and his power by systematising to store and apply acquired knowledge.

If we denote natural fertility or wealth of resources of the territory, say, by w; what may be called its geographical and climatic advantages by g; its other available resources when better scientific knowledge is applied, or even when new wants are created by advancing civilisation, by u; the factors expressing themselves in the matter of fecundity by f; through standard of living, including hygiene, by l; through intellectual knowledge and its range, energy, and wisdom of application by i; then we must regard the increased population as really a function of all these, that is to say—

$$(15).....P = P_0 \phi (w, g, u, f, l, i, ....t)$$

The influences of these elements are, in general, secular in character, i.e., they produce slow changes, some being manifest in the years of a decade, others only in many decades. They are all determining factors of the possibilities of population, but do not necessarily express its actuality.

Their specific character is such that ordinarily they produce gradual and more or less remote effects, rather than effects which are instantaneous and immediately of great magnitude. Such effect may tend towards a constant value, may increase, or diminish, but in all cases the consequent changes will be gradual. It is to be noted, however, that some of the factors may acquire for a short time an importance which, locally at any rate, may lead to rapid changes.

Factors of the kind considered are probably either non-periodic, or if periodic their period is secular.

A general solution, if it were possible, would presuppose that the way in which w, g, u, f, l and i, varied with elapsed time was determinable. This variation, however, is not susceptible of exact definition: nevertheless, the *form* of the functions expressing their effect on the rate of increase  $\rho$  is not always wholly indeterminable.

- 14. Variations which depend on natural resources, irrespective of human intervention.—This may include both periodic and non-periodic elements. The natural wealth of a territory, as unaffected by the intervention of man, is, in general though not invariably, a maximum initially, though its values may oscillate between very wide limits, owing to variations of meteorological or climatological factors. Where natural wealth is of a type that is subject to steady decline, its effect on the rate of increase may be represented for all practical cases probably by a very simple function of the elasped time.
- 15. Variations of rate of long periods.—Any periodicity in meteorological and other factors, affecting the natural wealth of a territory, however much their influence may be masked by other factors, will in most cases cause a collateral periodicity in rate of increase. This can be represented by such a formula as the following, viz.:—

$$(16)$$
... $ho_t/
ho_0 = 1 + [a_0 + a_1 \sin{(a_1 + rac{t}{T_1})} + a_2 \sin{(a_2 + rac{t}{T_2})} + {
m etc.}] + Q$ 

in which  $T_1$ ,  $T_2$ , etc., will represent the lengths of the various periods to which the elapsed time t is related;  $a_1$ ,  $a_2$ , etc., are intervals determining the epochs of  $T_1$ ,  $T_2$ , etc.; and finally  $a_1$ ,  $a_2$ , etc., are the amplitudes of the variation from the mean value. Thus necessarily—

$$(17)....a_0 = -(a_1 \sin a_1 + a_2 \sin a_2 + \text{etc.})$$

and Q will of course represent the effect of the other elements influencing the rate of increase to which reference will be made later. Equation (16) is specially suitable for representing fluctuations of long period, which are expressible in terms of a sine series.

<sup>&</sup>lt;sup>1</sup> Examples could be drawn in recent times from America or Australia. It may, however, even in regions which nevertheless can be made habitable, be actually zero, as for example, in the Sahara, in Arizona, and in some parts of Australia.

16. Representation of periodic elements in non-periodic form.—Where T is exceedingly long as compared with t, the numerator of the expression (16) may take a much more simple form, available probably for all practical cases. For putting—

(18) 
$$\begin{cases} A_{1} = \mathcal{E}\left[(a_{i}\cos \alpha_{i})/T_{i}\right]; & A_{2} = -\frac{1}{2!}\mathcal{E}\left[(a_{i}\sin \alpha_{i})/T_{i}^{2}\right]; \\ A_{3} = -\frac{1}{3!}\mathcal{E}\left[(a_{i}\cos \alpha_{i})/T_{i}^{3}\right]; & A_{4} = +\frac{1}{4!}\mathcal{E}\left[((a_{i}\sin \alpha_{i})/T_{i}^{4}\right]; \\ \text{etc., etc.,} & ; \text{ etc., etc.} \end{cases}$$

the limits of the summation being from i = 1 to i = n, and n being the number of periodic terms. Then remembering that

$$a_0 + \Sigma (a_i \sin a_i) = 0$$

with the same limits, we can express (16) in the form

(19)...
$$\rho_t/\rho = 1 + a_0 + a_1 \sin(a_1 + \frac{t}{T_1}) + \text{etc.} = 1 + A_1 t + A_2 t^2 + ... + \text{etc.}$$
 which, with (18), connects the coefficients with the amplitude and epoch of the periodic fluctuations.

The values of  $A_1$ ,  $A_2$ , etc., may be either positive, negative, or zero.

- 17. Influence of natural resources disclosed by advancing know-ledge.—Turning now to the question of the various terms in Q, viz., those representing in equation (15) the effect of u, f, l, and i on the rate of increase, we remark first of all that increased scientific knowledge, especially in physics and chemistry, suggests that possibly the available resources of Nature are practically without limit, (that is  $u = \infty$ ). This being so, the rate of increase may be regarded as dependent, not so much upon Nature's limitations as upon the extent and character of our knowledge, and of our energy and wisdom in applying it; that is, in the formula, it depends upon i, not upon u. We shall find, however, that Nature's limitations are very real, for rates of increase of population which characterise many countries at the present time cannot be maintained for several thousand years.
- 18. Influences of resources dependent upon human intervention.—
  There is a narrower sense, however, in which u may represent specific and finite quantities, which can be sufficiently indicated by two or three illustrations. Territories like portions of the Sahara in Africa, and of Arizona in America, apparently hopeless waste, may in response to the application of artesian water, become fertile and habitable. In ordinary agriculture, land, practically valueless in the state of Nature, may become valuable by the application of suitable fertilisers. The infertility of land which is due to the absence of the necessary micro-organisms, may, when once such organisms are introduced, quite disappear, and the potential wealth in the territory existing may have been quite undreamt of. Or yet again, the value to man of a natural product, utilisable in

the natural state, or after being treated technically, may be wholly unknown; the discovery of its real value may so change the economic conditions of a territory as to greatly facilitate increase of population. In these and many other similar ways, natural resources reacting to man's operation may be found to be very great, though at first apparently non-existent. It would obviously therefore be very difficult to assign a form to the function which is in any way to represent the effect of natural resources.

19. Effects of migration.—Migration operates in several ways on the rate of increase of population, viz.: (i.) By the actual addition or withdrawal of the migrants; (ii.) by the change of the constitution of the population, thus affecting its rate of fecundity; (iii.) by consequential economic changes which favour or impair the rate of increase. A complete expression for its effects would therefore be elaborate in form. Since, however, the community changed by migration tends to adjust itself to the economic condition of the country, the real elaboration into each component element is unnecessary, and the resultant of all the elements operating may take a relatively simple form.

Migration itself is of two forms—periodic and non-periodic. The population of countries, for example, which at certain seasons are visited by large numbers of tourists, or from which large numbers depart, may be taken as affording illustrations of periodic migration. The rate of influx or efflux is usually slow initially; it then increases, becoming a maximum; when it declines much in the same way. In form, the curve of absolute increase or decrease is somewhat similar to the probability curve, but the curve is probably rarely symmetrical with respect to the maximum ordinate.

Non-periodic migration may, in addition to the effect of its absolute amount, change the final rate of increase or leave it as it was originally. Although both periodic and non-periodic migration may be actually discontinuous, no material error will ordinarily be committed if it be assumed to be continuous, provided that in amount it be negligibly small for the part of the year when it has actually ceased. So that there is no serious objection to the use of an essentially continuous function.

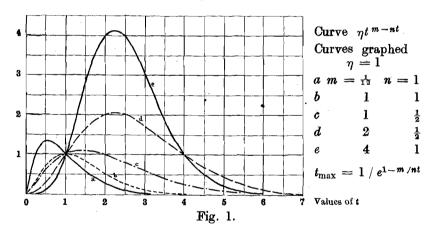
20. Simple variation of rate, returning asymptotically to original value.—Non-periodic migration of population, frequent in new countries, may produce a simple variation of rate which ultimately disappears. Owing to the reputation the territory acquires in respect of some real or supposed advantage, immigration sets in, increasing in rate till a maximum is reached, and declining again till the original rate is restored. For the territory or territories from which the emigration takes place, the converse effect may be true. If the rate can be ascertained at several periods, the total effect on the population can then be deduced with fair accuracy.

The simplest variation of this type, and one which will probably represent most instances with sufficient precision, may be expressed in the form—

$$(20)\ldots \rho_t/\rho_0 = 1 + \eta t^{m-nt}$$

 $\eta$  being positive for cases of immigration, and negative for those of emigration. This form would be suitable for deductions as to population based on the determination of rate of increase at various times.

By suitably selecting the unit of t, the parameter  $\eta$  and the indexnumbers m and n, equation (22) may be made to represent the very different circumstances which may obtain at the commencement, and during the development and passing away of the effect of migration on the original rate of increase. For example, it will express that type of migration in which the increments per unit of time to the rate of increase, though initially slow, grow and decrease with continually changing velocity, till the original rate is restored; or, on the other hand, it will express that type where the migration effect on the rate is sudden. This is illustrated by the curves in Fig. 1., viz.:—



Curves  $y = \eta t^{m+nt}$ 

in which the parameter  $\eta$  is unity throughout. The possible varieties of change of rate of increase are obvious from the figure, when it is remembered also that the horizontal proportions can be maintained, and the vertical changed at pleasure by simply altering the value of  $\eta$ .

21. Examination of exponential curves expressing variation of rate.—The curve of equation (20) demands special consideration. For brevity put R for  $(\rho_t - \rho_0) / \rho_0$ , then we can re-express (20) in the form<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> An expression of still greater fitting power is  $y = At^m e^{nt^p}$ . See a paper on the curve by G. H. Knibbs. Journ. Roy. Soc. N.S. Wales, Vol. XLIV., pp. 341-367.

therefore 
$$(20a) \quad \dots \quad R = \eta t^{m-nt}$$
 therefore 
$$(21) \dots dR / dt = \frac{\eta t^{m-nt}}{t} \{ m - nt (1 + \log_c t) \}$$
 
$$(21a) \dots \frac{dy}{dt} = \eta t^{m+nt} (n \log_e t + \frac{m}{t} + n)$$
 
$$(21b) \dots \frac{d^2y}{dt^2} = \eta t^{m+nt} \{ (n \log_e t + \frac{m}{t} + n)^2 + \frac{nt - m}{t^2} \}$$

and hence the value of t, which gives the maximum value for R, is found by solving the equation—

$$(22)..... m/n = t_{\text{max}} (1 + \log_e t_{\text{max}})$$

For the maximum to correspond to a value of t less than unity and greater than  $^{1}/e$ , the equation will be of the form  $t^{m-nt}$  (m and n being positive); or less than  $^{1}/e$  the equation will be of the form  $t^{-(m+nt)}$ . This equation can be solved by inspection, by means of the following table:—

TABLE I.

Argument t. Values of  $t \log_e t$ ,  $t (1 + \log_e t)$ , and  $t (-1 + \log_e t)$ 

	t	t loge t	$t (1 + \log_{\epsilon} t)$	$t(-1+\log_{\epsilon}t)$	t	$t \log_e t$	$t (1 + \log_e t)$
			0 (1 (10820)			- Toget	0 (1 (10520)
	0.1	0.2303n	0.1303n		1	0.0000	1.0000
	0.2	0.3219n	0.1219n	- !	2	1.3863	3.3863
	0.3	0.3612n	0.0612n	-	3	3.2958	6.2958
	0.4	0.3665n	• 0.0335	_· · ·	4	5.5452	9.5452
	0.5	0.3466n	0.1534	_	5	8.0472	13.0472
	0.6	0.3065n	0.2935		6	10.7506	16.7506
	0.7	0.2497n	0.4503	)	7	13.6214	20.6214
	0.8	0.1785n	0.6215		8	16.6355	24.6355
1,	0.9	0.0948n	0.8052		9	19.7750	28.7750
	1.0	0.0000	1.0000	9.0000	10	23.0259	33.0259
	1.1	0.1048	1.2048	9.0048	11	26.3768	37.3768
	1.2	0.2188	1.4188	9.0188	12	29.8189	41.8189
	1.3	0.3411	1.6411	9.0411	13	33.3443	46.3443
	1.4	0.4711	1.8711	9.0711	14	36.9444	50.9444
	1.5	0.6082	2.1082	9.1082	15	40.6208	55.6208
	1.6	0.7520	2.3520	9.1520	16	44,3614	60.3614
	1.7	0.9021	2.6021	9.2021	17	48.1646	65.1646
	1.8	1.0580	2.8580	9.2580	18	52.0267	70.0267
	1.9	1.2195	3.1195	9.3195	19	55.9443	74.9443
	2.0	1.3863	3.3863	9.3863	20	59.9146	79.9146
	2.1	1.5581	3.6581	9.4581	21	63.9350	84.9350
	2.2	1.7346	3.9346	9.5346		l —	
	2.3	1.9157	4.2157	9.6157			
	2.4	2.1011	4.5011	9.7011		·	- <u>-</u>
	2.5	2.2907	4.7907	9.7907			
	2.6	2.4843	5.0843	9.8843			
	2.7	2.6818	5.3818	9.9818			
	2.8	2.8829	5.6829	10.0829			
	2.9	3.0877	5.9877	10.1877			
	3.0	3.2958	6.2958	10.2958			—

Note.—The n denotes that the quantity is negative. In the column for  $t \log_{\epsilon} t$  and  $t (-1 + \log_{\epsilon} t)$ , the whole number 9 has been used in preference to the more awkward form  $\tau$ : in these cases the values given therefore exceed the true values by 10.

The suitability of the assumption of a curve of the type in question may be fairly well ascertained in the following way. For t=1,  $R=\eta$  in (20a) (the unit of t may be 1 week, 1 month, 1 quarter, or 1 year, say, according to the character of the migration under review).

Taking the logarithm of both sides of (20a) we have—

$$(23)....\log R = \log \eta + (m-nt)\log t$$

From the observed values of R, the values of  $\mathbb{R}$ 

$$(24).....R = (\log R - \log \eta) / \log t = m - nt$$

may be formed. These are plotted as ordinates, with the corresponding values of t as abscissæ; then if the points  $\mathfrak{L}$  lie on a straight line, m will be the intercept on the axis of ordinates, and n will be the tangent of the negative angle which the line of points makes with the axis of abscissæ. If they do not lie on a straight line, the assumption is invalid.

If, moreover, we have the epoch at which the rate was a maximum, we have also from (22) the ratio of m/n, and obviously the two should be in agreement. This is a further test of the validity of the assumption.

22. Determination of constants of such exponential curves.—The constants  $\eta$ , m and n in equation (20) may be found from three observations at any suitable intervals, say at the times  $t_1$ ,  $t_2$ , and  $t_3$ , the commencements of the fluctuation being therefore also known. If the value of R for t=1 is not known, put—

$$(25) \begin{cases} S_{2.1} = \log R_2 - \log R_1; \ S_{3.2} = \log R_3 - \log R_2 \\ u_{2.1} = \log t_2 - \log t_1; \ v_{2.1} = t_2 \log t_2 - t_1 \log t_1 \\ u_{3.2} = \log t_3 - \log t_2; \ v_{3.2} = t_3 \log t_3 - t_2 \log t_2 \end{cases}$$

then we shall have-

$$(26)....m = (S_{3,2}v_{2,1} - S_{2,1}v_{3,2}) / (u_{3,2}v_{2,1} - u_{2,1}v_{3,2})$$

and

$$(27)....n = (S_{3,2}u_{2,1} - S_{2,1}u_{3,2})/(u_{3,2}v_{2,1} - u_{2,1}v_{3,2})$$

The values of m and n being found,  $\eta$  is best found from.

$$(28)....\log \eta = \log R - (m - nt) \log t.$$

the suffixes of R and t being identical.

If, however, the rate for t=1 be known, then  $\eta$  is  $R_{t=1}$ ; and, see (24), the suffixes of  $\mathbb{R}$ , R and t being identical, we shall have—

$$(29),\ldots,m=(\mathbf{R}_2t_3-\mathbf{R}_3t_2)/(t_3-t_2)$$

and

$$(30)....n = (\mathbf{K}_2 - \mathbf{K}_3)/(t_3 - t_2)$$

a solution much less tedious than the former. The values of  $t_2$  and  $t_3$  must be well selected.

Obviously, if more than three values of R are taken, the application of the test indicated by equation (24) is necessary.

23. Case of total non-periodic migration represented by an exponential curve.—Where migration adds or subtracts its quota to the population only temporarily, as in cases of temporary migrations to or from a country, the exponential curve of equation (20) will often represent with exactitude, not merely the variations of the rate of increase, but of the absolute population. The complete expression put into non-periodic form would thus be, for the case in question—

$$(31)....P_t = P_0 \{e^{\rho t} + \eta (qt)^{m-nt}\}$$

the factor q depending upon the value of the unit of t used in (20) (i.e., if  $\eta$ , m and t be determined for months, then q = 12, t in  $e^{\rho t}$  being in years). This formula would represent a single migration effect, vanishing asymptotically. If the migration be itself proportioned to the magnitude of the population at each instant, as may often be the case, then the preceding equation (31) will become—

$$(31a)....P_t = P_0 e^{\rho t} \{1 + \eta (qt)^{m-nt}\}$$

In using either (31) or (31a), it is of course necessary that  $P_0$  be the population at the commencement of the migration effect; *i.e.*, the origin of t must be identical in both parts of the complete expression.

Yet again, if the expression represents only the variation of the rate, we shall have—

$$(31b).....P_t = P_0 e^{\rho t (1 + \eta t^{m-nt})}$$

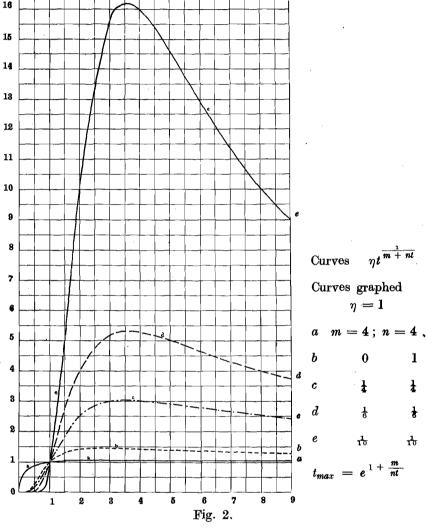
which, however, will be considered in a more general form hereinafter.

24. Simple variation of rate, returning asymptotically to a particular value.—A variation of rate may tend to return to some new value, greater say than the original. Such a variation can be expressed in the following way, viz.:—

$$(32).....\rho_t/\rho_0=1+\eta t^{\frac{1}{\pm m+nt}}$$

m and n being positive.

Since this curve becomes asymptotic to a line parallel to the t axis at the distance  $\eta$ , and has the ordinate value  $\eta$  for t=1, the unit by which t is measured must give an abscissa of unity for the first value  $\eta$  of the ordinate. This somewhat limits the convenience of its application. Some of the forms of the curve are illustrated by Fig. 2.



25. Examination of the preceding curve.—As in section (21), put

$$(32a)....R' = \eta t^{\frac{1}{\pm m + nt}}$$

then

$$(33).... d R' / dt = \frac{\eta t^{\frac{1}{\pm m + nt}}}{m + nt} \left\{ \frac{1}{t} - \frac{n \log_e t}{\pm m + nt} \right\}$$

and consequently the value of t which gives the maximum value for R' is found by solving the equation  $\frac{1}{t} = \frac{n \log_e t}{\pm m + nt}$  which leads to—

$$(34).....\frac{\pm m}{n} = t (\log_e t - 1)$$

For a maximum to correspond to a value of t greater than e, the equation will be of the form  $t^{\frac{1}{m+nt}}$  (m and n being positive); or less than e, equation will be of the form  $t^{\frac{1}{-m+nt}}$ . This may be solved for the series of values already given in Table I. for  $t(\log_e t - 1)$ : see section 21 hereinbefore.

Similarly to the preceding case we take the logarithm of both sides of (32a), we have—

$$(35).....\log R' = \log \eta + \log t / (\pm m + nt)$$

Hence as before, finding  $\mathbb{R}'$  from observed values of R' we have—

$$(36).....\mathbb{R} = \log t / (\log R' - \log \eta) = \pm m + nt$$

which enables us to examine the validity of the assumption, since it is the equation of a straight line of which the values of X' and t are respectively ordinates and abscissæ.

For the point of inflexion the second differential will be required: the sign of m being positive, it is—

(33a), 
$$\frac{d^{2}R^{2}}{dt^{2}} = \frac{\eta t^{\frac{1}{m+nt}}}{(m+nt)^{2}} \left\{ \left[ \frac{1}{t} - \frac{n}{m+nt} \log_{e} t \right]^{2} - \left[ \frac{1}{t} - \frac{n}{m+nt} \log_{e} t \right] - \left[ \frac{m}{t^{2}} + \frac{2n}{t} - \frac{n^{2}}{m+nt} \log_{e} t \right] \right\}$$

26. Determination of the constants of the curve.—In this case the rate for t=1 is known, and  $\eta=R'_t=1$ ; thus formula (29) holds when **R** is changed for **R**', and similarly in regard to (30) changing the sign, that is—

$$(37).....m = (\mathbf{X}'_2 t_8 - \mathbf{X}'_8 t_2) / (t_8 - t_2)$$

$$(38).....n = (\mathbf{X}'_3 - \mathbf{X}'_2) / (t_8 - t_2)$$

The test of (36) is necessary if there be more than three values of  $\mathbb{E}'$ . For the case of immigration  $\eta$  is positive, for emigration negative.

27. Total non-periodic migration resulting in permanent increase but returning to original rate.—Where the migration effect on total population adds or subtracts its quota, but leaves the original rate practically undisturbed, the result may be expressed similarly to (31), i.e.,

$$(39)....P_t = P_0 \left\{ e^{\rho t} + \eta \left( qt \right)^{\frac{1}{m+nt}} \right\}$$

and if as supposed in section 23 the migration be itself influenced at every moment by the magnitude of the population, (39) will become—

(39a).....
$$P_t = P_0 e^{\rho t} \{1 + \eta(qt)^{\frac{1}{\pm m + nt}}\}$$

- 28. The utility of the exponential curve of migration.—Formulæ (20) to (31b) are serviceable, when the population has to be determined by taking into account the rate of migration determined only at several suitable occasions, the intermediate migration being supposed to conform to the exponential curve assumed to represent all values intermediate to those determining it, and all future values so long as it is applied.
- 29. Fluctuation of annual periodicity.—The instantaneous rate of increase of the population of any country, at least where the population is at all numerous, must, during the course of the year, indicate a yearly period, since both the migration rate and the birth and death rates have, in general, a characteristic annual fluctuation. There is sometimes a difference, however, between the migration fluctuation, and that due to births and deaths, for the former, owing to local circumstances, is sometimes confined to a part of the year only, while the two latter extend over the entire year. The scheme of expressing long periodic fluctuations has already been indicated, viz., in equations (16) to (19). Continuous fluctuations of short periods may with advantage be put in the form—
- $(40)\dots \rho_t/\rho_0=1+a_0+a_1\sin{(a_1+\mu_1t)}+a_2\sin{(a_2+\mu_2t)}+$  etc. where  $\mu_1$  and  $\mu_2$  are whole numbers or proper or improper fractions, defining definitely ascertained periods, and where, as before, we must necessarily have—

$$(41)....a_0 = -\sum a \sin \alpha;$$

see section (17); or yet again, if the true period is not known and a curve known by experience is to be empirically reproduced, then we may put

$$(42)...\rho_1/\rho_0 = 1 + a_0 + a_1 \sin (a_1 + \frac{2\pi}{n}t) + a_2 \sin 2 (a_2 + \frac{2\pi}{n}t) + a_3 \sin 3(a_3 + \frac{2\pi}{n}t) + \text{etc.},$$

the unit of t being the period (e.g., one year) embracing all the fluctuations to be reproduced in the period following.

30. Discontinuous periodic variations of rate.—We may assume that the continuous rate is any function of t, i.e.,  $\rho_t = \phi(t)$  say. Suppose that superimposed on this curve, there is a migration effect existing for parts of the year only, reappearing at the corresponding times in each following year. Let us suppose further that in the intervals, there is no variation of rate through migration, the fluctuation being fully expressed by  $\phi(t)$  above. Then, provided that suitable values are given to the constant  $a_0$  to the amplitudes  $a_1$ ,  $a_2$ , etc., and to the epochal angles  $a_1$ ,  $a_2$ , etc., the fluctuation of rate may be represented by such an expression as—

(43).....
$$\rho_{t}/\rho_{0} = \phi(t) \pm \sqrt{\{a_{0} + a_{1} \sin{(a_{1} + \frac{2\pi}{n}t)} + \text{etc.}\}}$$

the + sign denoting immigration effects, and the - sign emigration effects. For the final term will have no *real* values when the quantity under the radical sign becomes negative:  $a_0$  must of course satisfy the conditions expressed by equation (17) hereinbefore.

Similarly, fluctuations of other character may be represented by-

(43a).... 
$$\rho_t/\rho_0 = \phi(t) \pm \sqrt{\{a_0 + a_1 \sin (a_1 + t/T_1) + \text{etc.}\}}$$
 or again by—

(43b)....
$$\rho_t/\rho_0 = \phi(t) \pm \sqrt{(at + bt^2 + ct^3 + \text{etc.})}$$

Since only real values can have any meaning the expressions under the radical sign in (43), and (43a) and (43b) are discontinuous, the discontinuity extending from each value of t where the value of the expression changes from + to -, to where it changes from - to + again.

31. Empirical expression for secular fluctuations of rate.—For the purpose of prediction it is usual to deal either with mean population or the population at a particular date, say the end of the year. The fluctuations of rate may be empirically determined from past records and put in the exponential form, viz.,

$$(44)....
ho_t/
ho_0=1+\eta t^{k+mt+nt^2+ ext{ etc.}}$$

 $\eta$ , k, m, n, etc., being integral or fractional, positive or negative. Or again, it may be expressed in the form—

$$(45).....\rho_{t}/\rho_{0} = 1 + at + \beta t^{2} + \gamma t^{3} + \text{etc.}$$

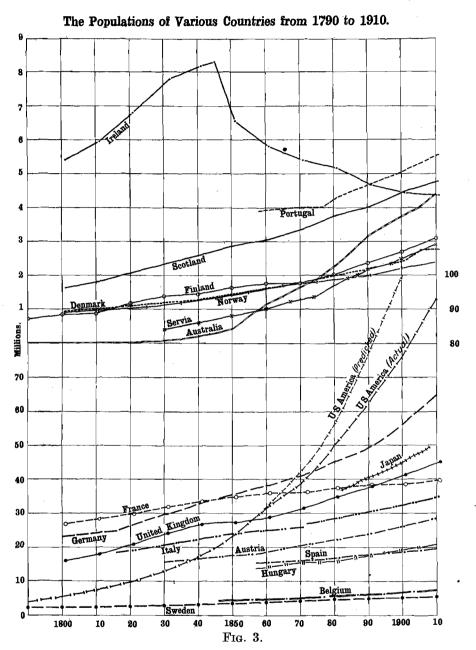
or yet again in the form-

$$(45a).....\rho_t/\rho_0 = 1 + at^p + \beta t^q + \gamma t^r + \text{etc.}$$

in which p, q, r, etc., are in ascending order of magnitude, but not restricted to integral values. The fitting efficiency of this latter form is much greater than where the indices are restricted to integral values, <sup>1</sup> but the determination of the constants a,  $\beta$ ,  $\gamma$ , etc., and p, q, r, etc., are not so convenient.

32. Growth of various populations.—Populations increase when the additions by birth and immigration together exceed the deductions through death and emigration together. The rate of increase differs greatly as between country and country, and differs from decade to decade, so that it cannot be regarded as in any sense uniform even for short periods of time. This is evident from Fig. 3, in which the growth of the populations of a larger number of countries is shewn by their progression every decade, and is still more obvious in Fig. 4 (shewing their logarithmic homologues) by the changes in the slope of the lines. In the following table, the populations, given in millions and decimals of a million, are those shewn on Fig. 3.

Obviously, since both the coefficients and indices are at our disposal, it is easy to see that attempts to apply (45) to the curve  $y=at^p$ , where p is a proper or improper fraction, are invalid. It is also invalid for the curve  $y=at^p+bt^p+q+$  etc.

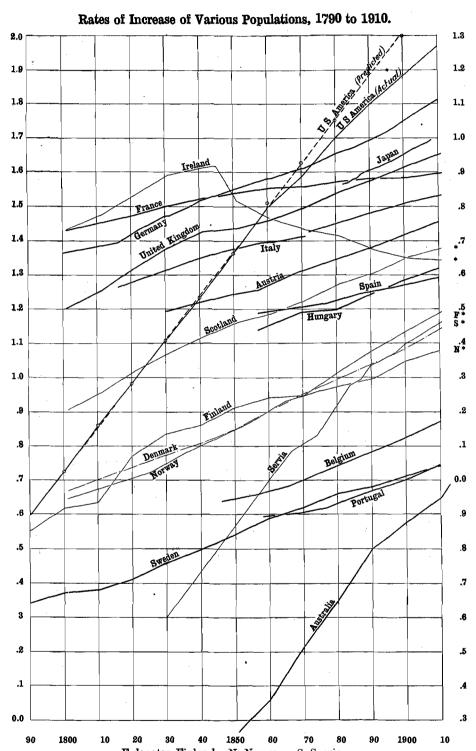


The scale for the lower part of the figure denotes ten times the numbers of the scale for the higher part. The predicted population for the United States was based on the assumption that the rate for 1790 to 1800 would be maintained constant. On the scale of the figure this curve substantially agrees with the prediction by Elkanah Watson in 1815.

Table II .- Populations in Millions, of Various Countries.

Q.,						Years,										
Country.			1790-9,		1800-9.		18	310-9.	18	320-9.	1830-9.		18	340-9.	1	850-9
Commonwez United Kin Scotland Ireland Austria Belgium Denmark France German y Hungary Italy Norway Portugal Spain Sweden Finland Servia			0	.002     2.19	0 1 1 1 1 1 0  1  0 0	.005 15.90 1.61 5.40  .93 26.93 23.18  .88 	0 1 1 1  6  6	.01 17.91 1.81 5.94  24.83 18.38  2.40 .86	0 1 1 1 1	.03 20.89 2.09 6.80  29.87 27.04 19.73 1.05  2.58 1.18	0 1 1 1 0 4 1 1 1 8 5	.07 24.03 2.36 7.77 15.59 .1.22 31.89 29.77 .21.98 1.19 	0 1 1 1 0 6 0 0 1 0  8 5 	.19 26.71 2.62 8.18 16.58 4.34 1.28 33.40 32.79  23.62 1.33  3.14 1.45	0 1 1 1 0 6 0 0 1 2 7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	27.3° 2.89 6.50 17.50 4.53 4.54 34.7° 35.90 13.7° 24.8° 1.4° 3.9° 15.4° 3.1.6°
U.S. America 0 3.93				93   0   5.31   0   7.24   0   9.64   0   12.87   0   17.07   0   23.18 YEARS.												
•	Countr	Y.			18	360-9.	18	370-9.	18	380-9.	18	890-9.	19	900-9.	1	910-9
Commonwe: United Kin Scotland Ireland Austria Belgium Denmark France Germany Hungary Haly Japan Norway Portugal Spain Sweden Finland Servia U.S. Ameri	gdom				0 1 1 1 1 9 6 0 0 1 1 1 7 2 2	1.15 28.93 3.06 5.80 20.39 4.83 1.60 35.84 38.14 1.22 25.00 1.70 4.00  8.66 1.75 1.00	0 1 1 1  0 2 1 0 1  5 7 7 0 0 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1.65 31.49 3.36 5.41  1.78 36.10 41.06 15.51 25.96  4.16 16.43 4.17 1.77 1.35	0 1 1 1 1 0 0 0 0 1 1 0 0 0 1 2 1 7 0 0 0 0 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2.23 34.88 3.74 5.17 22.14 5.52 1.7,7 37.41 45.23 15.74 28.46 36.70 4.31 17.55 4.57 2.06 1.90 50.16	0 1 1 1 0 0 0 1 0 0 1 0 0 1 0 0 0 0 0 0	3.65 37,73 4.03 4.70 23.90 6.07 21.17 38.13 49.43 17.46 30.46 40.45 1.99 4.66 18.32 4.78 2.38 2.16 62.62	0 1 1 1 1 0 0 1 1 1 0 0 0 1 0 0 0 0 0 0	3.77 41.46 4.47 4.46 26.15 6.69 2.45 56.37 19.25 32.48 44.83 2.22 5.02 18.61 2.71 2.71 2.71 2.71	0 1 1 1 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0	4.44 45.22 4.7 4.3 28.5 7.4 2.7 39.6 64.9 20.8 34.6 50.3 5.5 5.5 5.5 3.1 2.9 93.3

33. Rate of increase of various populations.—Fig. 3 and the accompanying table reveal directly only the relative magnitude of the populations, but not their exact rate of growth. The latter is displayed on Fig. 4, in which (the scale being constant) the steepness of slope of the line represents the rapidity of the rate of increase. As before mentioned, this rate is very irregular from decade to decade, as would be revealed by dividing the population at the end of each decade by that at the beginning thereof and comparing the numbers; i.e., by finding and comparing, for example, the values of  $P_n/P_0$  giving those of 1+r. The rates tabulated hereunder are the annual rates which, if maintained constant, would produce the populations at the end of the decades; that is, they are the values of r found from  $\log (1+r) = (\log P_n - \log P_0)/n$ , where n is the intervening number of years.



F denotes Finland; N, Norway; S, Servia.

\* The logarithms for Australia, Denmark, Finland, Ireland, Norway, Scotland, and Servia are shewn on the right of the figure; for the others, on the left.

Fig. 4.

Table III.—Annual Rate of Increase per 10,000 of Population of Various Countries.

	APPROXIMATE DECADE,												
COUNTRY.	1790 to 1799	1800 to 1809	1810 to 1819	1820 to 1829	1830 to 1839	1840 to 1849	1850 to 1859	1860 to 1869	1870 to 1879	1880 to 1889	1890 to 1899	1900 to 1909	
wealth	976	829	1124	764	1052	785	1095	370	308	351	180	163	
J. K'dom*		120	155	141	106	24	56	85	103	79	95	87	
cotland*		118	145	122	105	99	57	94	108	75	104	63	
reland*		96	136	134	52	-225	-122	70	45	96	53	16	
ustria			<del>-</del>	_	62	56	152	41;	41‡	77	90	89	
Belgium†					i	43	64	96**	96**	96	98	104	
enmark*	-	<del></del> .			80 §	97	127	107	102	97	122	127	
rance*		521	52‡	66	46	39	32	_7	36	19	. 8	30	
ermany	_	43(a)	143	114	108	77	66	74	108	89	132	142	
Iungary taly			_			$\frac{-}{72}$	41**	86** 42	$\frac{17}{92}$	104 68	64 64	51	
I O TOWN OF THE		74(d)	74(3)	79(b)	83(c)	114	133	69	56(a)		122	58 74	
lower-mol		(4(a)	74(d)	126	112	114	100	20	58(c)	87	75	92	
nain -	_						_	30t	301	66	33(e)	67	
weden	71	21	73	111	87	103	104	77	92	45	73	71	
inland	157	36	321	150	57	124	65	12	153	145	131	$14\hat{2}$	
ervia							- 1	190**	348	216	143	157	
apan*			_ ;			_	_			116	110	118	
J. States	306	315	291	293	286	311	309	206	267	224	198	205	

<sup>\*</sup> Add 1 year to date for proper decade. † Add 6 years up to 1860 inclusive. ‡ Rate for 20 years. \*\* Rate for 14 years. § Rate for 6 years. (a) Rate for 16 years. (b) Rate for 9 years. (c) Rate for 13 years. (d) Rate for 24 years.

34. The population of the world and the rate of its increase.—In dealing with the magnitude of the population of any country and the rate of its growth, the most general comparison is that made with the entire population of the world and its rate of growth. This, however, is not well ascertained. Recently, for example, the estimate for China's population has been reduced over 100 millions. The following table gives results of different estimates:—

Table IV.—Estimates of World's Population.\*

Year.	Authority.	Estimate (Millions).	Year.	Authority.	Estimate (Millions).
1660	Riccioli	1,000	1813	Graberg v. Hemsö	686
1685	Isaak Vossius	500	1816	A. Balbi	704
1740	Nic. Struyck	500	1822	Reichard	732
1672	Riccioli	1,000	1824	G. Hassel	938
1742	J. P. Sussmilch	950 to 1,000	1828	G. Hassel	850
1753	Voltaire	1,600	1828	I. Bergius	893
1761	J. P. Sussmilch	1,080	1828	A. Balbi	737
1789	W. Black	800 to 1,000	1828	Balbi*	847
1804	Malte-Brun*	640	1833	Stein	872
1804	Volney	437	1838	Fränzl	950
1805	Pinkerton	700	1838	V. Rougemont	850
1805	Fabri	700	1840	Omalius d'Halloy	750
1809	G. Hassel	682	1840	Bernoulli	764
1810	Almanach de Gotha*	682	1840	v. Roon	864
1812	Morse	766	1843	Balbi	739

Table IV.—Estimates of World's Population\*—continued.

Year.	Authority.	Estimate (Millions).	Year.	Authority.	Estimate (Millions).	
1843	H. Berghaus	1,272	1880	Behm & Wagner	1,456	
1845	Michelot*	1,009	1882	Behm & Wagner	1,434	
1854	v. Reden	1,135	1883	1,433		
1889	Dieterici	1,288	1886	Levasseur*	1,483	
1866	E. Behm	1,350	1891	Ravenstein*	1,467	
1868	Kolb	1,270	1896	Statesman's* Year	1,493	
1868	E. Behm	1,375	1903	Juraschek* [Book	1,512	
1870	E. Behm	1,359	1906	Juraschek*	1,538	
1872	Behm & Wagner	1,377	1910	Annuaire Statistique		
1873	Behm & Wagner	1,391	ll .	d. l. Rep. Française*	:	
1874	Behm & Wagner*	1,391	K	Juraschek*	1,610	
1878	Levasseur*	1,439	1913	Knibbs*	1,632	
1878	Levasseur	1,439	1,649			

\* These will be found on the graph, Fig. 5.

This table shews, for the period 1804 to 1914, rates of annual increase ranging between 0.0015 and 0.01211 and averaging about 0.00864.

We may obtain some idea of the present rate of growth by taking the weighted mean of the rate for the known countries; that is, each rate of increase is weighted according to the population. In this way, it is found for the quinquennium 1906 to 1911, and for the group of countries in the Table V. hereinafter, that the general result is a rate of increase of 0.01159 per annum, or 1.159 per cent. of the population.

Table V.—Annual Increase per 10,000 Population for the quinquennium 1906-1911.

	ry.		Rate	Years†	Country.	Rate.	Years†	
Ireland				_ 6		Switzerland	+ 121	57.6
France				+16	436	Netherlands	122	57.2
Jamaica				28	248	Denmark	126	55.4
Scotland				55	126	German Empire	136	51.3
Norway				66	105	Finland	143	48.8
Belgium				-69	101	Rumania	148	47.2
Italy				80	87	Servia	155	45.1
Sweden				84	82.9	Chile	156	44.8
Hungary				84	82.9	United States	182	38 4
Austria				86	80.9	Commonwealth	203	34.5
Spain				87	80:0	New Zealand	256	27.4
England	and W	ales		104	67.0	Canada	298	23.6
Japan				108	64.5			_
Ceylon	••	••	• •	120	58.1	Weighted Average*	+115.9	60.1

\* Weighted average according to population. † Years necessary for the population to be doubled in value at the rate indicated.

The number of years 
$$n$$
 in which a population, increasing at the rate  $r$ , is doubled, may be very readily computed thus:

$$(1+r)^n = 2; \text{ therefore } n \log_e (1+r) = \log_e 2 = 0.693147$$

$$\text{consequently } n = \frac{0.69315}{\log_e (1+r)} = \frac{0.69315}{r(1-\frac{r}{2}+\frac{r^2}{3}-\ldots)}$$
but where  $r$  is very greatly are reported at the rate  $r$  is the rate  $r$  to great  $r$  the rate  $r$ .

but when r is very small we may neglect powers higher than the second (that is  $\frac{1}{2}r$  in the brackets); hence

$$n = \frac{0.69315}{r}$$
  $(1 + \frac{1}{2}r)$ , sensibly,  $= \frac{0.693}{r} + 0.347$ 

<sup>&</sup>lt;sup>1</sup> On taking the mean of Levasseur and Behm & Wagner, and again of Levasseur and Ravenstein.

Either this rate of increase must be enormously greater than has existed in the past history of the world or enormous numbers of human beings must have been blotted out by catastrophes of various kinds from time to time. For, putting the present population at 1,649,000,000, at the average rate of increase this number would be produced from a single pair of human beings in about 1782 years,\* that is to say, since A.D. 132, or since Salvius Julianus revised under Hadrian the Edicts of the Prætors. Even the rate given by the world-populations 1804 and 1914, viz. (0.0086) gives only 2397 years, carrying us back only to B.C. 483, or since the days of Darius I. of Persia.

The profound significance of this fact, accentuated also by the extraordinary increase in the length of life (expectation of life at age 0), which has revealed itself of recent years, is obvious when the correlative food requirements are taken into account. The resources of Nature will have to be exploited in the future more successfully than in the past to maintain this rate of increase (0.01159), which doubles the population every 60.15 years, and would give for 10,000 years the colossal number 22,184, with 46 noughts (1046) after it.

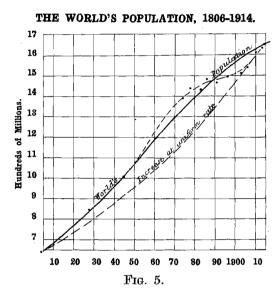
This number is so colossal that it is difficult to appreciate its magnitude. Assuming the earth to be a globe of 3960 miles radius, of a density 5.527 compared with water, that water weighs about  $62\frac{1}{2}$  lbs. per cubic foot, and that a human being weighs on the average, say, 100 lbs. (7 st. 2 lbs.), the actual mass of the earth would be equivalent only to, say,  $132,265 \times 10^{18}$  persons; that is, it would require 16,771x 10<sup>23</sup> times as much "matter" as there is in the earth. Or, to consider it as a question of surface, allowing  $1\frac{1}{2}$  square feet per person, the earth's entire surface area would provide standing room for only 36,625 x 1011 That is, the population would be  $60,570 \times 10^{30}$  times as great as there would be standing room if the whole earth's surface were available. It is evident from this that the rate of increase of human beings must have been more approximate to the rate for France at the present time, if the earth has been peopled for 10,000 years: the French rate, 0.0016, would require 12,842 years to give the present population from a single pair. This rate, however, would give a population of only 17.55 millions in 10,000 years.

The foregoing analysis of the effect of the rate of increase, with which we are familiar, establishes the fact that the rate must have passed through great changes, and could not have been maintained for any long period, either at its present average, or that characteristic of the last century. (See II. § 12, 13, 14 and 15.) It is not improbable that the rate of the last quinquennium will not be long maintained; and it is

<sup>\*</sup> Thus dividing by 2, we have  $824,500,000 = (1.01159)^n$  where n is the number of years, that is, n = 1.782.

certain that however great human genius or effort may be, in enlarging the world's food supplies, that rate cannot possibly be maintained for many centuries. The contention of Malthus is thus placed beyond question, from a different point of view.

The analysis also suggests that there are probably great oscillations of the rate of increase, but since accurate records date back for so comparatively short a time, no general indication of their character can be given.



In Fig. 5 some of the estimates are shewn by black dots. The firm line drawn among these dots is intended to represent the probable development of the world's population. The thin broken line among the dots, though adhering more closely to the various estimates, is, however, of doubtful probability. The lower broken line represents a population increasing at a uniform rate from 640 millions in 1804 to 1649 millions in 1914; i.e., 110 years. From the figure it is evident that the rate of increase in the early part of last century has fallen off, and the world's population increase will continue at a less rapid rate. Thus it is beyond question that there have been oscillations of rate, but their period has not yet been determined, and is perhaps not determinable, owing to lack of data. One thing is assured, viz., that the present rate of increase cannot be maintained for any lengthy period.

## III.—DETERMINATION OF CURVE-CONSTANTS AND OF INTER-MEDIATE VALUES WHEN THE DATA ARE INSTANTANEOUS VALUES.

- 1. General.—The data of statistics are usually to hand in two essentially different forms, viz., (a) instantaneous values or numbers which are true at a given moment; as, for example, the population of a country at a given instant; and (b) group values or numbers belonging to some particular interval of time, as the number of births per month, or per annum, for a population of given magnitude. Some indications have already been given of suitable formulæ for instantaneous values, and in one or two instances the mode of deducing their constants was also furnished. We proceed to consider the solution for the constants of equations which are appropriate for representing instantaneous values. In mathematical language, if y = f(x), then having chosen the form of the function, it remains to determine its constants from the data. In the case of group values, the equations must denote the value of the integral of the function between given limits, and the problem has special features, the study of which will be undertaken later (IV.) There are a considerable number of cases of importance, some of which are aperiodic, and others periodic.
- 2. Determination of constants where a fluctuation is represented by an integral function of one variable.—When, as is ordinarily the case, the data consist of values corresponding to equal intervals of time, as, for example, the population at the end of each quarter, at the end of each year, or at the end of each ten years, etc., the fluctuation may be empirically represented by the equation.

(46)....y (or 
$$\frac{1}{y}$$
) =  $a + bx + cx^2 + dx^3 + \text{etc.}$ ,

in which, in the above illustration, x represents time. In this case the number of constants to be determined will depend upon the number of instants for which we have data. Two classes of cases arise, viz., (i.) eases in which the data furnish the initial value;  $(y_0)$ , that is, a in the equation above, and (ii.) cases in which the initial value is not furnished, but is for a unit interval of time before the first result available. In other words, in the equation above, we require a series of solutions for the cases where a has a fixed value, including zero, and when it is undetermined; or what is the same thing, when we have either  $y_0$  or  $y_1$  as the

initial datum. If we have the value of  $y_0$ , then n subsequent points will require an integral equation of the nth degree. If not, n points, including  $y_1$ , necessitate an integral equation of the (n-1)th degree.

If k denote the common interval of time (represented by distance between the ordinates), the values of y in the preceding expression are:—

(47)..
$$y_0=a$$
;  $y_1=a+bk+ck+$  etc.;  $y_2=a+2bk+4ck^2+$  etc., etc.

If a be known, then by subtracting a from the values of y we have a series of equations identical with the above in which—

(48)....
$$y_0 = 0$$
;  $y_1 = bk + ck + \text{etc.}$ :  $y_2 = 2bk + 4ck^2 + \text{etc.}$ 

We deal first with the cases where a is known and assume that the ordinates  $y_1$ ,  $y_2$ , etc., are the values computed from the axis X, so taken that a=0. Then the following formulæ, in which  $y_1$  is denoted by i,  $y_2$  by ii., etc., may be readily deduced:—

Formulae when  $y_0 = 0 = a$ .

For- mula.	Data.	Value of b.	Value of c.
(49)	$y_1$	$\frac{1}{k}$ (i.)	
(50)	$y_1$ and $y_2$	$\frac{1}{2k}  (4iii.)$	$\frac{1}{2k^2}$ (—21.+ii.)
(51)	$y_1$ to $y_3$	$\frac{1}{6k}$ (18i.—9ii. + 2iii.)	$\frac{1}{2k^2}$ (5i.+4iiiii.)
52)	$y_1$ to $y_4$	$\frac{1}{12k}$ (48i.—36ii.+16iii.—3iv.)	$\frac{1}{24k^2}$ (—104i. +114ii. —56iii. +11iv.)
(53)	y <sub>1</sub> to y <sub>5</sub>	$\frac{1}{60k}$ (300i.—300ii.+200iii.—75iv.+12v.)	$\frac{1}{24k^2}$ (-154i.+214ii156iii.+61iv10v.)
For- mula,	Data.	Value of d.	Value of e.
(51a)	$y_1$ to $y_3$	$\frac{1}{6k^3} \text{ (3i3ii.+iii.)}$ $\frac{1}{12k^3} \text{ (18i24ii.+14iii3iv.)}$	
			$\frac{1}{24k^4}$ (-4i.+6ii4iii.+iv.)
(53a)	y <sub>1</sub> to y <sub>5</sub>	$\frac{1}{24k^3}$ (+71i.—118ii.+98iii.—41iv.+7v.)	$\frac{1}{24k^4}(14i.+26ii24iii.+11iv2v.)$
(53b)	$y_1$ to $y_6$	Value of $f \approx \frac{1}{120k}$ s (+5i.—10ii.+10iii.—5i	iv. + 1v.)

Instead of using the value of the ordinates it is often convenient to form the successive differences, and then the coefficients b to f can be expressed very briefly in terms of the leading differences of the ordinates, corresponding to the values 0, k, 2k, etc., of the abscissa. In the following results,  $D_1$ ,  $D_2$ , etc., represent the successive leading differences, that is, remembering that  $y_0=0$ ;  $D_1=y_1$ ;  $D_2=y_2-2y_1$ ;  $D_3=y_3-3y_2+3y_1$ ; etc.; etc.

<sup>&</sup>lt;sup>1</sup> See II., § 6, formulæ (9) to (13a).

For- nula,	Data.	Value of b.	Value of c.				
(54)	y <sub>1</sub>	$-\frac{1}{k}$ D					
		$\frac{1}{2k}$ (2 $D_1 - D_2$ )		$\frac{1}{2k^2}$ $D_2$			
		$\frac{1}{6k} \ (6D_1 - 3D_2 + 2D_3)$		$\frac{1}{2k^2}$ $(D_2-D_3)$			
	1	$\frac{1}{12k} (12D_1 - 6D_2 + 4D_3 - 3D_4)$		$\frac{1}{24k^2}$ (12 $D_2$ —12 $k$			
/E 0 \		$\frac{1}{60k}$ (60 $D_1$ —30 $D_2$ + 20 $D_3$ —15 $D_4$	بر 19 تەر	$\frac{1}{2}$ (127) 123			
(86)	y <sub>1</sub> to y <sub>5</sub>	60k (00 D1 00 D2 + 20 D3 - 10 D4	.T12108/	24k 1222 123	$D_3 + 11D_4 - 10D_5$ ).		
For- nula.	Data.	<u> </u>		Value of e	$D_3 + 11D_3 - 10D_8$ ).  Value of $f$		
For- nula. (56a)	Data.	Value of $d$ $\frac{1}{6k^3} D_3$					
For- nula. (56a)	Data.	Value of d	V				

Secondly, when a is not known, and the ordinates  $y_1$ ,  $y_2$ , etc., are distant k, 2k, etc., from the Y-axis, we may readily extrapolate a by means of the differences. For the coefficients are simply the numbers of Pascal's triangle (the binomial coefficients) with the first omitted. Thus, the small Roman figures denoting suffixes only, we have—

(59)...
$$a = 2i$$
. – ii.; or 3i. – 3ii. + iii.; or 4i. – 6ii. + 4iii. – iv.; or 5i. – 10ii. + 10iii. – 5iv. + v.; or 6i. – 15ii. + 20iii. – 15iv. + 6v. – vi.

for two, three, etc., ordinates given. When a is found, the problem resolves itself into that for which solutions have already been given, or it may be directly solved. For five ordinates given, not including a, we have, for example:—

## Formulæ.

$$(60)....a = 5i. - 10ii. + 10iii. - 5iv. + v.$$

$$(61)....b = \frac{1}{12k} (-77i. + 214ii. - 234iii. + 122iv. - 25v.)$$

$$(62)....c = \frac{1}{24k^2} (71i. - 236ii. + 294iii. - 164iv. + 35v.)$$

$$(63)....d = \frac{1}{12k^3} (-7i. + 26ii. - 36iii. + 22iv. - 5v.)$$

$$(64)....e = \frac{1}{24k^4} (i. - 4ii. + 6iii. - 4iv. + v.)$$

The values of the coefficients in terms of the leading differences (D) are:

$$(65)....a = y_1 - D_1 + D_2 - D_3 + D_4$$

$$(66)....b = \frac{1}{12k} (12D_1 - 18D_2 + 22D_3 - 25D_4)$$

$$(67)....c = \frac{1}{24k^2} (12D_2 - 24D_3 + 35D_4)$$

$$(68)....d = \frac{1}{12k^3} (2D_3 - 5D_4)$$

$$(69)....e = \frac{1}{24k^4} D_4$$

3. Evaluation of the differences from the coefficients.—When the coefficients of an integral function, viz., one of the form (46), are known, and it is desired to ascertain the values of the ordinates  $y_0$ ,  $y_1$ ,  $y_2$ , etc., the common interval between which is k, they may be rapidly computed from differences, viz., from x=0 and y=a, together with the following leading differences:—

Factor into numerical coefficient below—
Differences.  $bk + ck^2 + dk^3 + ek^4 + fk^5$ .  $\begin{bmatrix}
D_1 & 1 & 1 & 1 & 1 \\
D_2 & 2 & 6 & 14 & 30 \\
D_3 & 6 & 36 & 150 \\
D_4 & 24 & 240 \\
D_5 & 120
\end{bmatrix}$ 

For equations of less degree than the fifth the table still serves since f, e, etc., may be put equal to 0.

4. Subdivision of intervals.—When the ordinates are to hand for a series of intervals, those for a subdivision of these into m parts may readily be determined by computing a new series of lesser leading differences, d say, using those, D say, of the original intervals, as a basis, as follows:—

$$\frac{\text{Differ-} \frac{D_{1}}{m} \frac{D_{2}}{m^{2}}}{\frac{D_{3}}{m^{2}}} \frac{D_{3}}{m^{3}} \frac{D_{4}}{m^{4}} \frac{D_{5}}{m^{5}}$$

$$\frac{d_{1}=1-\frac{m-1}{2}+\frac{2m^{2}-3m+1}{6}-\frac{6m^{3}-11m^{2}+6m-1}{24}+\frac{24m^{4}-50m^{3}+35m^{2}-10m+1}{120}}{d_{2}=1-(m-1)+\frac{11m^{2}-18m+7}{12}-\frac{10m^{3}-21m^{2}+14m-3}{12}}{d_{3}=\frac{3m-3}{2}+\frac{7m^{2}-12m+5}{4}}$$

$$\frac{d_{4}=\dots 1-\frac{3m-3}{2}+\frac{7m^{2}-12m+5}{4}}{d_{4}=\dots 1-\frac{3m-3}{4}}$$

$$\frac{d_{4}=\dots 1-\frac{3m-3}{2}+\frac{7m^{2}-12m+5}{4}}{2(m-1)}$$

That is, we divide the nth difference by  $m^n$ , and this factor is multiplied into the expression opposite d with the proper suffix. The sum of the terms gives the leading difference in the corresponding d in the first column.1

When an interval is divided into 2, 4, 8 or 16, etc., parts, the ordinates may be found by successive "interpolations into the middle.

5. Evaluation of constants of periodic fluctuations.—The general empirical formula for a periodic curve which may be made to fit given data is-

(72)..
$$y$$
 (or  $\frac{1}{y}$ ) =  $a+b \sin (\beta+x)+c \sin 2 (\gamma +x)+d \sin 3 (\delta+x)+$  etc.

in which the number of terms to be taken depends upon the given data, and is sufficiently illustrated hereunder.

When the values of y are given only for the beginning of the recurring period of the total fluctuation and at the end of the first half period, we have-

$$(73)....y = a + b \sin (\beta + x)$$

$$(74)....a = \frac{1}{2}(y_0 + y_1); b \sin \beta = \frac{1}{2}(y_0 - y_1)$$

Hence if any definite value be assigned to b,  $\beta$  becomes determinate; or if to  $\beta$ , b becomes determinate.

When there are values of y for the beginning of the total period, and for the instants one-third and two-thirds of the period, then we have, writing-

$$y_0 - a = r_0; \ y_1 - a = r_1; \text{ etc.}$$

(75).....
$$a = \frac{1}{3}(y_0 + y_1 + y_2); \tan \beta = \frac{\sqrt{3} r_0;}{r_1 - r_2}$$

a and  $\beta$  being found, we have—

(76)....
$$b = r_0 \operatorname{cosec} \beta$$

Using  $r_n$  throughout to denote  $y_n - a$ , where n is 0, 1, 2, etc., we have for four values, viz., at the beginning of a period and at one-fourth, two-fourths, and three-fourths of the period, from the beginning-

(77)... 
$$a = \frac{1}{4} (y_0 + y_1 + y_2 + y_3)$$
;  $\tan \beta = \frac{y_0 - y_2}{y_1 - y_3}$  and in the expression for  $\tan \beta$ , we may write  $r$  for  $y$ .

These quantities being found, we then have-

$$(78)...b = r_0 \operatorname{cosec} \beta = r_1 \operatorname{sec} \beta.$$

For fifth periods, that is, for equidistant ordinates 0 to 4, the formulæ for the constants are :---

$$(79) \dots y = a + b \sin (\beta + x) + c \sin 2 (\gamma + x)$$

<sup>&</sup>lt;sup>1</sup> See Text Book Institute of Actuaries, Pt. II., Ed. 1902, p. 443.

and the solution gives-

$$(80) \dots a = \frac{1}{5} \sum_{0}^{3} y.$$

$$(81) \dots a = \frac{1}{5} \sum_{0}^{3} y.$$

$$(82) \dots b = \frac{\cos c \beta \left\{ r_{0} - 2 \cos 36^{0} \left( r_{1} + r_{3} \right) \right\}}{3 + 2 \cos 72^{0}}.$$

$$(83) \dots \tan 2 \gamma = \frac{2 \sin 36^{0} \left\{ r_{0} - 2 \cos 36^{0} \left( r_{2} + r_{3} \right) \right\}}{r_{1} - r_{4} - 2 \cos 36^{0} \left( r_{2} + r_{3} \right)}$$

$$(84) \dots c = \csc 2\gamma. \frac{r_{0}(2 + 2 \cos 72^{0}) + 2 \cos 36^{0} \left( r_{2} + r_{3} \right)}{3 + 2 \cos 72^{0}}$$

 $3+2\cos 72^{0}$ .

The values of sin 36°, cos 36°, sin 72°, and cos 72° are respectively:  $\frac{1}{4}\sqrt{(10-2\sqrt{5})} = 0.5877853; \frac{1}{4}(\sqrt{5}+1) = 0.8090170; \frac{1}{4}\sqrt{(10+2\sqrt{5})} =$ 0.9510565; and  $\frac{1}{4}(\sqrt{5}-1)=0.3090170$ .

For sixth periods, that is, for equidistant ordinates 0 to 5 the formulæ for the constants are :-

The solution for twelfth periods is sometimes required as, for example, when values are to hand for the beginning of each month. Denoting as before the remainders  $y_n - a$  by  $r_n$  we have—

$$(90)....a = \frac{1}{12} \Sigma_{\circ}^{\iota\iota} y.$$

Then making the following additions for brevity of working, viz.-

$$(95)......c = \frac{1}{4\sqrt{3}} \sec 2\gamma (N_1 + N_2)$$

$$(96).... \tan 3\delta = \frac{M_0 - M_2}{M_1 - M_3}$$

$$(97)......d = \frac{1}{6} \csc 3\delta (M_0 - M_2)$$

$$(98)..... \tan 4\epsilon = \frac{\sqrt{3}L_0}{L_1 - L_2}$$

$$(99)......e = \frac{1}{4} \csc 4\epsilon L_0$$

$$(100).... \tan 5 \zeta = \frac{2R_0 - \sqrt{3}R_1 - R_2 + \sqrt{3}R_3}{R_1 - \sqrt{3}R_2 + R_3}$$

$$(101)......f = \frac{1}{12} \csc 5\zeta (2R_0 - \sqrt{3}R_1 - R_2 + \sqrt{3}R_3)$$

6. Constants of exponential curves.—The case of a curve of the type

$$(102)\ldots y = 1 \pm \eta t^{\pm m \pm nt}$$

see equation (20), has already been sufficiently considered: its constants can be found as shewn by formulæ (23) to (30); and also that of the type, see equation (32)

$$(103)....y=1+\eta t^{\frac{1}{\pm m\pm nt}};$$

see formulæ (35) to (38). In general, curves of this type may be solved by forming the equations y'=y-1 and taking logarithms when we get such forms as—

$$(104)...u = \epsilon + \log t \ (\pm m \pm nt) \ \text{and} \ u = \epsilon \frac{\log t}{\pm m \pm nt}$$

solutions for which have already been sufficiently indicated. As this process of taking logarithms is the key to many solutions, we now refer more fully to the matter. The essence of this method of solving is that if a series of values on the axis of abscissæ be taken in geometrical progression, their logarithms are in arithmetical progression. Thus,  $\chi$  being log x, we have—

Quantities = 
$$x$$
;  $kx$ ;  $k^2x$ ;  $k^3x$ ; etc.;

Logarithms of same =  $\chi$ ;  $\chi + k$ ;  $\chi + 2k$ ;  $\chi + 3k$ ; etc.

Hence the problems of solution are reduced to those of the examples illustrated by formulæ (46) to (71).

7. Evaluation of the constants of various curves representing types of fluctuation.—The evaluation of the constants of various curves can often be effected by taking suitable ordinates to the curve and solving from their logarithms. This is illustrated in the following series of equations:—

$$(105)... \mathfrak{P} = \mathfrak{C}e^{AX^m} = \mathfrak{C}e^{AM^x} = \mathfrak{C}\mathfrak{A}^{X^m} = \mathfrak{C}\mathfrak{A}^{M^x}$$

We have on taking napierian logarithms-

$$(106)....Y = AX^m + C = AM^x + C$$

in which  $\log \mathfrak{F} = Y$ ;  $\log \mathfrak{C} = C$ ;  $\log \mathfrak{A} = A$ ;  $\log X = x$ ; and  $\log M = m$ .

The second curve may be called the first logarithmic homologue of the first, and the first the first anti-logarithmic generatrix of the second. Subsequent curves may be similarly defined as the second logarithmic homologue, etc.

Yet again, if  ${\it C}$  be zero, we have on taking the logarithm of this last expression—

$$(107)....y = a + mx,$$

in which  $\log Y = y$ ; and  $\log A = a$ .

This will sufficiently illustrate the matter. Several examples of solution will be given of important curves for representing fluctuation.

In the curve

$$(108)....y = A + Bx^m$$

If A = 0; then the solution is found at once from any two values of y and of x. For we have—

$$(109)....\log y = \log B + m \log x.$$

On Fig. 21 hereinafter, these curves are shewn by thick lines for positive values of m, and by thin lines for negative values.

If, however, A be not zero, then we must take three values of y for abscissx of the value x, xk,  $xk^2$ , when it may easily be shewn that—

(110)... 
$$\frac{y_3 - y_2}{y_2 - y_1} = k^n$$
; or  $n = \frac{\log(y_3 - y_2) - \log(y_2 - y_1)}{\log k}$ 

The curve

$$(111)....y = B + Ce^{ax}$$

can be solved by taking the values of y for x, x + k, x + 2k, for

(112)..... 
$$\frac{y_3 - y_2}{y_2 - y_1} = \frac{C \left[ e^{a(x + 2k)} - e^{a(x + k)} \right]}{C \left[ e^{a(x + k)} - e^{ax} \right]} = e^{ak}$$

Consequently putting  $Y_{321}$  for the left-hand expression, and writing 2.3025851 for the modulus for changing common into Napierian logarithms

$$(113)....a = \frac{2.3026}{k} \log_{10} Y_{321}$$

When a is found the solutions for B and C are obvious. Curves of the equation  $e^x$  are shewn by thick lines on Fig. 22 hereinafter, and those of equation  $1 / e^x$  by thin lines.

The exponential curve—

$$(114)....y = A + Be^{nx^p}$$

can be solved if A be zero, or if A be known, and a new series of y'=y-A be formed. Thus A being zero,

$$(114a)....\log y = \log B + nx^p \log e.$$

Hence, as before, taking three values of y for x, xk,  $xk^2$ , the solution is—

(115)..... 
$$p = \frac{1}{\log k}$$
 .  $\log \left\{ \frac{\log y_3 - \log y_2}{\log y_2 - \log y_1} \right\}$   
(116).....  $n = \frac{\log y_2 - \log y_1}{x^p (k^p - 1) \log e}$   
(117).....  $\log B = \log y_1 - nx^p \log e$ .

These curves are shewn for Fig. 23 hereinafter, for various values of n and p.

The curve-

$$(118)....y = Ax^m e^{nx^p}$$

is solved by taking four ordinates, viz., for x, xk,  $xk^2$ ,  $xk^3$ , when the solution becomes 1—

$$(119)....p = \frac{1}{\log k} \cdot \log \left\{ \frac{\log y_2 - 2 \log y_3 + \log y_4}{\log y_1 - 2 \log y_2 + \log y_3} \right\}$$

using common logarithms. Then M denoting log e, we have also—

$$(120)...n = \frac{(\log y_1 - 2\log y_2 + \log y_3)}{Mx^p(k^p - 1)^2} = \frac{(\log y_2 - 2\log y_3 + \log y_4)}{Mx^pk^p(k^p - 1)^2}$$

$$(121)....m = \frac{(\log y_2 - \log y_1) - Mnx^p(k^p - 1)}{\log k}$$

There are obviously two other possible formulæ for m.

(122).. 
$$\log A = \log y_1 - m \log x_1 + Mnx^p$$

the value of M being 0.4342945. Three other formulæ are also possible for A. For further formulæ see (150) to (153) later; see also Figs. 21 to 27, hereinafter, for the forms of the curve.

8. **Polymorphic and other fluctuations.**—Monomorphic or rather unimodal curves disclose a single maximum (or minimum) value. But there are fluctuations which are polymorphic or multimodal. These may be regarded as compounded of monomorphic curves. Practically their dissection is best effected by the graphic methods of analysis. In general any curve can be represented with great accuracy by either

(123).....
$$y = a + bx^p + cx^q + dx^r + \text{etc.}$$
, or by (124).....  $Y = e^{a + bx^p + cx^q + \text{etc.}}$ 

where p, q, r, etc., are not restricted to integral values.

The latter curve is reduced to the former by taking the logarithm; thus,  $y = \log_{\theta} Y$ . To solve for the constants we must have six points besides the origin. If the value of a be known, the curve can be reduced to one passing through the origin by subtracting a. Then we take values of y for x, xk,  $xk^2$ ,  $xk^3$ , etc. For the case for terms in p and q only, we can proceed as follows:—

<sup>&</sup>lt;sup>1</sup> For a more complete study of the curve, see "Studies in Statistical Representation. On the Nature of the Curve," above given, viz. (118), by G. H. Knibbs, Journ. Roy. Soc., Vol. XLIV., pp. 341-367, 1910.

By writing L for  $bx^p$  and M for  $cx^q$ , and a for  $k^p$  and  $\beta$  for  $k^q$ ; we have-

 $(125)...y_1 = L + M; y_2 = L\alpha + M\beta; y_3 = L\alpha^2 + M\beta^2; y_4 = L\alpha^3 + M\beta^3$ Hence by eliminating L and M from the first three and from the last three equations, we have respectively-

$$(127).....\begin{vmatrix} 1 & y_1 & y_2 \\ \xi & y_2 & y_3 \\ \xi^2 & y_3 & y_4 \end{vmatrix} = 0$$

Thus the two values of  $\xi$  in the equation—

 $(128)..\xi^2 - \xi(\alpha + \beta) + \alpha\beta = \xi^2(y_1y_3 - y_2^2) + \xi(y_2y_3 - y_1y_4) + (y_2y_4 - y_3^2) = 0$ are the values of  $k^p$  and  $k^q$ . And since k is known, the solution is to hand by taking logarithms.

The solution for three indices is similar. The six equations can be written-

(129).....
$$y_{m+1} = La^m + M\beta^m + N\gamma^m$$
 and  $\alpha$ ,  $\beta$ , and  $\gamma$ ; that is  $k^p$ ,  $k^q$ , and  $k^r$ , are the roots of the equation.

$$(130).....\begin{vmatrix} 1 & y_1 & y_2 & y_3 \\ \xi & y_2 & y_3 & y_4 \\ \xi^2 & y_3 & y_4 & y_5 \\ \xi^3 & y_4 & y_5 & y_6 \end{vmatrix} = 0$$

which may be expanded in the form-

(130a)..... 
$$A_1\xi^3-3\,A_2\xi^2+3\,A_3\xi-A_4=0$$
 where  $A_1,3\,A_2,3\,A_3$  and  $A_4$  are the minors respectively of  $\xi^3,\,\xi^2,\,\xi$  and 1 in the determinant.

If the constant a is included in (123) or (124), the solution is more tedious. We must then have seven values of y. Thus-

$$(131)....y_{m+1}=a+La^m+M\beta^m+R\gamma^m$$

(131a).... 
$$y_{m+2} - y_{m+1} = L'\alpha^m + M'\beta^m + R'\gamma^m$$

the accented values being L' = L(a - 1);  $M' = M(\beta - 1)$ ; etc.

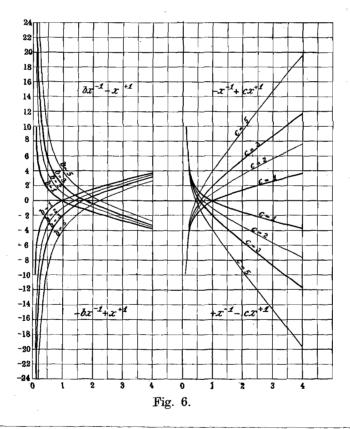
Thus  $\alpha$ ,  $\beta$ , and  $\gamma$  are the roots of—

$$(132).....\begin{vmatrix} 1 & y_2 - y_1 & y_3 - y_2 & y_4 - y_3 \\ \xi & y_3 - y_2 & y_4 - y_3 & y_5 - y_4 \\ \xi^2 & y_4 - y_3 & y_5 - y_4 & y_6 - y_5 \\ \xi^3 & y_5 - y_4 & y_6 - y_5 & y_7 - y_6 \end{vmatrix} = 0$$

$$(183).....\xi^3Y_3 - \xi^2Y_2 + \xi Y_1 - Y_0 = 0.$$

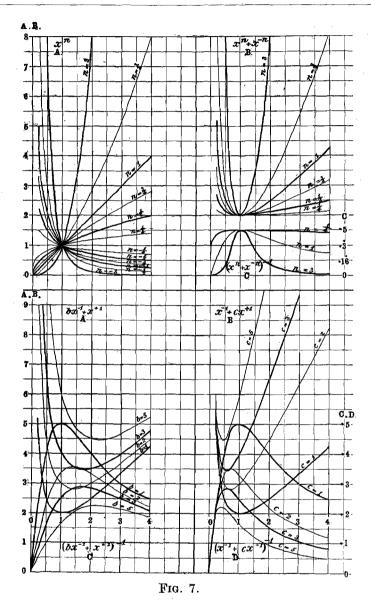
It will be seen from the preceding examples that when, as regards their indices, the equations are not restricted to integral values, the fitting power of the curve is enormously increased. To fit seven points with integral indices we should have to have an equation of the sixth degree.<sup>1</sup>

Figures 6 and 7 furnish graphs for simple cases with two indices only. From these graphs, which also are for integral values of the index only, it is immediately evident that the loci of curves with fractional values must lie between the curves drawn. The forms of the curves may, of course, be modified also by varying the coefficients: hence the fitting power of expressions of the type considered obviously becomes very great when the limitation imposed by restricting the indices solely to integral values is abandoned.<sup>2</sup>



<sup>&</sup>lt;sup>1</sup> See "Studies in Statistical Representation, III., Curves, their Logarithmic Homologues," etc., by G. H. Knibbs and F.W. Barford, Journ. Roy. Soc. N.S.Wales, Vol. XLVIII., pp. 473-496

<sup>&</sup>lt;sup>2</sup> The limitations of the fitting power of the curve are discussed in the paper referred to in the preceding footnote. These limitations, in general, are of no moment in statistical results.



Some special cases of fluctuation will now be treated in dealing with problems treating of fluctuating elements that directly or indirectly influence the aggregate or constitution of the population.

9. Projective anamorphosis.—A symmetrical curve of frequency (or symmetrical distribution) may become asymmetrical by the elements being projectively varied by means of different types of projection (plane or other). This change may be called *projective anamorphosis*. Any character of a population may be regarded as subject to influence acting

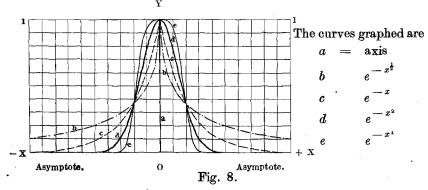
progressively (or retrogressively) with increase of the measure of the character in question, as for example, if the influence tending to increase weight (or height) acted more or less powerfully with increase of that character. This would lead to an asymmetric or skew frequency. Thus if a normal frequency be denoted by  $y = \phi(x)$ ; a specialised frequency conceived to originate therefrom would be given by  $y' = f(x) \phi(x)$ . This expression may also be skew, dimorphic, polymorphic, or in fact, what we please, according to the character of f(x). If f(x)=mx or m/x, a symmetrical curve is converted into a skew curve. If f(x) have a mode such that it is not identical with that of  $\phi$  (x) the latter will be dimorphic. From this it is seen that the ordinates to a dimorphic curve may be the sum or product of the ordinates to two monomorphic curves. It is not proposed to elaborate just here, however, the general theory of anamorphosis by plane or other projection. It may be easily seen, however, that a skew curve may be readily derived from a symmetrical one, while retaining the general algebraical properties of the latter, by a projection, from a line parallel to the axis of the given symmetrical curve, through the curve and on to a plane passing through the axis but inclined to the plane of the given curve. This will be more fully considered hereinafter.

## IV.—SPECIAL TYPES OF CURVES AND THEIR CHARACTERISTICS.

1. **General.**—When the characters of a population have a tendency to deviate in either direction equally, and the number of the population is P, the characters will be distributed as the coefficients  $(\frac{1}{2} + \frac{1}{2})^m$  *i.e.*, as the numbers in Pascal's triangle, which, when m is infinite, becomes the curve

$$(134)....y = Pe^{-\left(\frac{x}{k}\right)^2}; \text{ or say } Pe^{-\left(\frac{x}{k}\right)^n}$$

the first form (viz., that when the power n=2) being the ordinary probability curve, in which k is the modulus. This type of distribution is but one case of the more general expression which, interpreted in a certain way, has a cusp for the vertex for values of n equal to or less than unity, and a curve convex upwards for all values greater than unity, the vertex however becoming more flat as n is increased.



The curve  $y = e^{-x^{\frac{1}{20}}}$  is coincident with a from the point Y to a point y = 0.3678781; it is then parallel to the X axis. All the curves intersect at this point.

Such a distribution is symmetrical, and takes the form in the figure hereunder, Fig. 7, in which curve 'a' shews its form for n = 0; 'b' for  $n = \frac{1}{2}$ ; 'c' for n = 1; 'd' for n = 2; 'e' for n = 4.

When the probabilities of distribution are not equal for possible alternatives, and the probabilities of these alternatives are as p and q, the sum of p and q being unity, then the distribution will be the coefficients of  $(p+q)^m$ . If q and p are not equal the curve is not symmetrical, but is of a form like Fig. 9 hereinafter. Whether results can be made to conform to a particular type or not depends on the form of the curve, and

<sup>&</sup>lt;sup>1</sup> That is, so that  $e^{-x^n}$  and  $e^{-x(n+\delta n)}$  are in the same spatial region, or on the same side of an axis, and are not allocated to different regions according to whether the number  $(n+\delta n)$  is even or odd.

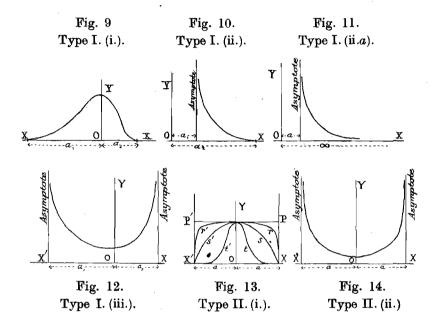
in particular on the position of its vertex; on whether its sides meet the axis of the variable more or less sharply or asymptotically, on whether it is monomorphic or polymorphic, or has one "mode" (is unimodal) or more modes than one (is multimodal). Various types of unimodal fluctuations, commencing and ending with zero values or otherwise, have been given by Prof. Pearson. These are intended to reproduce the group-values of statistical data, under appropriate forms of curves, by a method which has been called the method of moments, the forms of the curves being derived from the normal curve of probability. We shall later refer to these, but remark first of all that the critical elements of the curves representing distributions or fluctuations are as follows, viz.:-

- (a) the value of the ordinate when the variable is zero;
- (b) the values of the variable for which the ordinates become zero;\*
- (c) or, if they do not become zero, the value of the ordinate when the variable is infinity;
- (d) the abscissa of the mode, or greatest ordinate, and the value of that ordinate:
- (e) the abscissa of the ordinate which equally divides the curve area (as, for example, the abscissa which corresponds to the average value, or the centroid vertical);
- (f) the distance between these two ordinates (d) and (e) (the numerator of the quantity defining the skewness);
- (g) the mean-deviation of the curve (or denominator of the skewness);
- (h) the abscissa of the point where the curvature changes its sign, (point of inflexion);
- (i) the abscissa of the point of most rapid change of direction of the curve.

- (a).....y = f(0); (b).....f(x) = 0; (c)..... $f(\infty) = k$  or 0; (d)..... $x_m$  when df(x) / dx = 0; and  $y_m = f(x_m)$ ; (e)..... $x_a$  when the value of  $\int xf(x) dx \div \int f(x) dx$  for the range of the variable up to  $x_a$  is equal to that for  $x_a$  onward;
- $(f)\ldots(x_a\sim x_m)$
- $(g) \dots m_2 = \sqrt{[x^2 f(\chi) d\chi \div \int f(\chi) dx]}$ , in which  $\chi$  is measured from the position of the mean  $(x_a)$ .
- $(h)....x_i$  when  $d^2f(x) / dx^2 = 0$ ;
- (i).... $x_n$  when  $d^3f(x)/dx^3=0$ .

<sup>\*</sup> The approach of statistical curves to the axis of abscissæ or to the axis of ordinates is, in general, not determined by mathematical considerations, but by a knowledge of the nature of the data itself. For example, the terminals of the curve of fertility (discussed hereinafter) deduced from ex-nuptial births, shews a diminution which may be represented very closely by the numbers 1078, 154, 22, 3‡, for the ages 16, 15, 14 and 13 respectively, i.e., each number is one-seventh of the number preceding it. Merely mathematically, therefore, it is more probable that these should continue for the ages 12, 11, 10, 9, etc., as 0.45; 0.064; 0.009; 0.0013, etc. Even at age 0 there would, of course, be still a positive value though small. But physiological knowledge indicates that the earliest arrival of puberty is probably over 10 years bence 11 would be the earliest are for birth, and the ordinate must over 10 years, hence 11 would be the earliest age for birth, and the ordinate must be zero.

2. Curves of generalised probability.—Prof. Pearson proposes to reduce forms of distribution of statistical facts under a series of seven type-forms of curves, representing what may be called curves of generalised probability, and much work has been reduced on this system.



His first type (Type I.) is :-

$$(135)....y_0 = y \left(1 + \frac{x}{a_1}\right)^{\nu a_1} \left(1 - \frac{x}{a_2}\right)^{\nu a_2}$$

which may take two other fundamental sub-forms, viz.,

(136)..... 
$$y = y_0 \left(\frac{x}{a_1} - 1\right)^{-\nu a_1} \left(1 - \frac{x}{a_2}\right)^{\nu a_2}$$
; and

$$(137).....y = y_0 \left(1 - \frac{x}{a_1}\right)^{-\nu a_1} \left(1 + \frac{x}{a_2}\right)^{-\nu a_2}$$

which are represented respectively by the forms in Figs. 9 to  $12.^2$  When  $\nu$ ,  $a_1$  and  $a_2$  are positive the curve meets the X axis at the distances  $a_1$  and  $a_2$ , see the figures. The abscissa of the mode is 0 and the curve is skew.

<sup>&</sup>lt;sup>1</sup> See his "Contributions to the Mathematical Theory of Evolution." Phil. Trans., Vol. 185 (1894) A, pp. 71-110; Vol. 186 (1895) A, pp. 343-414; Vol. 187 (1896) A, pp. 253-318; Vol. 191 (1898) A, pp. 229-311; Vol. 192 (1898) A, pp. 169-244; Vol. 192 (1899) A, pp. 257-330; Vol. 195 (1900) A, pp. 1-47; Vol. 195 (1900) A, pp. 79-150; Vol. 197 (1901) A, pp. 285-379; Vol. 197 (1901) A, pp. 443-459.

<sup>&</sup>lt;sup>2</sup> See Phil. Trans., Vol. 186 A, pp. 364-5.

. If, in the formula for Type I.,  $a_2$  be made equal to  $a_1$ , then the formula becomes that of Type II., shewn by Figs. 13 and 14, viz.—

$$(138)....y = y_0 \left(1 - \frac{x^2}{a^2}\right)^{\nu_0}$$

 $(138).....y = y_0 (1 - \frac{x^2}{a^2})^{\alpha}$  the *basic form* of which, when  $y_0$  is unity, is an ellipse with semiaxes aand 1. The figure becomes a circle when  $\nu$  is  $\frac{1}{2}$  and a is 1. In general, any form can be deduced from the basic form which, when va is unity, is a parabola (the quantity within the brackets) in (138). If this quantity be infinite and positive the figure becomes X' P' Y P X: see Fig. 13. If positive and greater than unity, it is the curve r'r; if unity it is the parabola s's; if less than unity, the curve t't in Fig. 13. The abscissa of the mode is 0, and the curve is of course symmetrical.

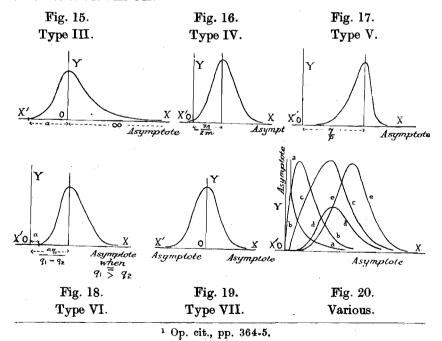
If  $\nu$  be made negative in (138) the formula becomes

$$(139)....y = y_0 \frac{1}{\left(1 - \frac{x^2}{a^2}\right)^a}$$

and is shewn by Fig. 14. The abscissa of the mode (of mediocrity) is at the origin.

If in the second sub-form of Type I. we make 
$$a_2$$
 infinity, then 
$$(140)....y = y_0 \ (\frac{x}{a} - 1)^{-\nu a} \, e^{-\nu x}$$

the form of which is shewn in Fig. 11; that is, the curve is asymptotic to the ordinate whose abscissa is distant +a from the origin, and asymptotic also to the axis OX.



When in formula (135)  $a_2$  is infinity, then its form becomes Type III., viz.,

$$(141)....y = y_0 (1 + \frac{x}{a})^{\nu a} e^{-\nu x}$$

and is of the form shewn in Fig. 15. The abscissa of the mode is at the origin, and the curve is skew.

Type IV. is of the form shewn in Fig. 16; its equation being:-

$$(142)....y = \left(1 + \frac{x^2}{a^2}\right)^{-m} e^{-\nu \tan^{-1}x/a}; \text{ or } = y_0 \cos^{2m} \theta \cdot e^{-\nu \theta}$$

 $\theta$  being the angle the tangent of which is x/a. The curve is asymptotic to the X axis on both branches; its mode is at the distance  $-\nu a/2m$  from the origin, and it is skew: see Fig. 16.

Type V., is of the form shewn in Fig. 17, and its equation is:-

$$(143)....y = y_0 x^p e^{-\frac{\gamma}{x}}$$

The curve is limited on one side at the axis X, i.e., for x=0, and is asymptotic thereto at the other; its mode being at the distance  $\gamma/p$ . The curve is skew. The mean is at the distance  $\gamma/(p-2)$  from the origin.

Type VI. is of the form shewn in Fig. 18. Its equation is:-

$$(144)....y = y_0 (x-a)^{q_2} x^{-q_1}$$

The curve is limited on one side only, viz., when x = a. The mode is at  $aq_1/(q_1 - q_2)$ .

Type VII. is the ordinary probability curve: see Fig. 19, viz.:

$$(145)....y = y_0 e^{-\frac{x^3}{c}}$$

the mode being at the origin and the curve unlimited in either direction, and of course symmetrical.

Curves a to e, Fig. 20, are typical forms of the following characteristics in a population, viz.:—

- (a) Infantile mortality, income, probates, value of houses, etc.;
- (b) Mortality from scarlet fever, diphtheria, etc.;
- (c) Pauper frequency, divorce frequency with respect to duration of marriage, frequency of scarlet fever with age, of typhus, etc.;
- (d) Senile mortality, mortality from enteric at different ages, frequency of marriage of wives corresponding to age of husbands at marriage, etc.;
- (e) Height, weight, strength frequency, anthropometric measurements, etc.

3. The method of evaluating the constants of the curves of generalised probability.—Two things are requisite in using the Pearson curves, viz. (i.) to select the appropriate type of curve; and (ii.) to evaluate the constants of the selected curve. The selection of a curve which can be made to fit the given group-data depends upon relationships among the moments calculated about the mean. These relationships determine three criteria, which, after the necessary computations have been made, indicate the appropriate selection.

Solutions can also be effected by means of a combination of graphical and numerical methods. The numerical solutions can be effected by taking logarithms, that is,

$$(146)....\log y = \log y_0 + \log f(x).$$

The process in detail can readily be followed from the examples in III. (See in particular § 7). In general the solution must be tentative, and it is important to notice that the type-curve selected is not valid if the data have to be altered larger amounts than they are probably in error. The principle which should be employed is the following:—The adoption of a type-curve can be regarded as satisfactory only when it represents the data within the limits of their probable errors. In other words the geometric form and the algebraic processes should be subordinated to the data and not vice versa.

4. Flexible curves.—Although the type-curves just considered fulfil their general purpose fairly well, experience shews that their "fitting power" is somewhat limited. To overcome this, other types are necessary, the "fitting power" of which is greater. In order to embrace as many forms as possible under cover of a single formula a curve may be so taken that its limiting forms shall include all parabolas, all hyperbolas (or parabolas with negative indices), all exponentials with positive or negative indices, and all curves of the normal probability type. Such a curve will necessarily include all intermediate forms. I have called this type of curve a flexible curve.

Formula (149) in the next section is a curve of the type in question. Its graph depends fundamentally upon the values of the indices m, n, and p, and its vertical scale depends upon the constant A. The mode of solving to determine its constants depends upon taking a series of values of the abscissa in geometrical ratio, and is indicated in the next section.

<sup>&</sup>lt;sup>1</sup> See the article by Professor Pearson already referred to, also "Frequency Curves and Correlation," by W. Palin Elderton (C. and E. Layton, London, 1906); and "Statistical Methods with special reference to Biological Variation," by C. B. Davenport (Chapman and Hall Ltd., London, 1904).

The curves indicated on p. 57 and p. 81 of Mr. W. Palin Elderton's work do not satisfactorily represent the data, for a much as the curves chosen were insufficiently flexible.

5. Determination of the constants of a flexible curve.—The probability curve, see (134) hereinbefore, viz.,

(147)....y = 
$$Ce^{-\frac{x^2}{k^2}}$$
 or  $e^{-\frac{x^2}{k^2}+c}$ 

in which  $c = \log_e C$ , may be put in a more general form, viz.

$$(148)....y = e^{-\frac{x^2}{f(x)} + F(x) + o}$$

that is, its modulus k and constant C may be assumed to be functions of x. If we suppose that

$$F(x) = a + \beta \log (\pm x); f(x) = \gamma x^s; c = 0;$$

and write p = 2 - s;  $n = -1/\gamma$ ;  $\log A = \alpha$ ;  $m = \beta$ , the expression (148) can be written

$$(149)....y = Ax^m e^{nx^p}$$

see (II8) in III. 7. This curve can fit a great variety of forms, viz., such as are shewn on Figs. 21 to 27, referred to later.

In practice it is not quite satisfactory to depend on four points. A better fit can be secured by taking several, say r, series of ordinates for values of the abscissa  $x_a$ ,  $k_a x_a ldots ldots k_a^3 x_a ldots ldots x_r$ ,  $k_r x_r ldots$ 

$$(150)....p \log (k_a.k_b....k_r) = \log \{ \prod_{1}^{r} (Y_{234}/Y_{123}) \};$$

 $\Pi_1^r$  denoting the product of r different sets of the quantities in the brackets.

The use of this mean value of p, being inconsistent with each set of four ordinates, gives for each set two solutions for n, three for m, and four for A, that is in all 2r, 3r and 4r solutions respectively for these constants. Having found the mean value for p we use it, in solving for a mean value of n, thus:—1

(151)... 
$$r \log n = \log \frac{\prod_{1}^{r} (\log y_{1} - \log y_{2} - \log y_{3} + \log y_{4})}{\prod_{1}^{r} \{Mx^{p} (k^{2p} - 1) (k^{p} - 1)\}};$$
 or

(151a).... 
$$n = \frac{\sum_{1}^{r} \log (y_1 y_4 / y_2 y_3)}{\sum_{1}^{r} \{Mx^p (k^p + 1) (k^p - 1)^2\}}$$

<sup>&</sup>lt;sup>1</sup> By comparing this with (120) it will be seen that the mean is taken of two quantities each of which give n, on the principle that if a/b=c/d approximately (a+c)/(b+d) is sensibly the arithmetic mean, or having two equations which give n, we assign an equal weight to each. The geometric mean, however, is taken in obtaining a mean result from the different sets. Of course  $(n_1 + \dots n_p)/r$  would also be a satisfactory value, n here denoting the value obtained by using the mean value of p. Although the two formulæ are not identical, practically there is no cogent reason for preferring one to the other.

Adopting the mean values, thus found, for p and n, we have three different values for m given by each set. Reverting to formula (121), if we give double weight to the value found from the intermediate term we get<sup>1</sup>

$$m = \frac{-\sum_{1}^{r} (\log y_{1} + \log y_{2}) + \sum_{1}^{r} (\log y_{3} + \log y_{4}) - Mn \sum_{1} \{x^{p} (k^{2p} - 1)(k^{p} + 1)\}}{4\sum_{1}^{r} \log k}$$

Mean values for p, n and m being to hand, we have for A four values from each set of ordinates, see (122) hereinbefore, the general formula being

$$(153).....\log A = \log y_h - \log (k^{h-1} x) - Mn (k^{h-1} x)^p.$$

hence for a mean of 4r values of A we have

(153a)..log 
$$A = \frac{1}{4r} \left\{ \sum_{1}^{r} \log \left( y_{1} y_{2} y_{3} y_{4} \right) - 4m \sum_{1}^{r} \left( \log x + \frac{3}{2} \log k \right) - Mn \sum_{1}^{r} \left[ x^{p} \left( k^{3p} + k^{2p} + k^{p} + 1 \right) \right] \right\}$$

M denotes throughout 0.434..etc., if common logarithms are employed, or unity if Napierian.

Ignoring the coefficient A the first and second derivatives of the curve (149) are respectively

$$(154)\ldots dy / dx = x^{m-1} e^{nx^{p}} (m + npx^{p});$$
 and

$$(155)...d^{2}y/dx^{2} = x^{m-2}e^{nx^{p}}\left\{m(m-1) + npx^{p}(2m+p-1) + n^{2}p^{2}x^{2p}\right\}$$

hence the mode (maximum or minimum value) is given by

$$(156)....x = (-m/np)^{\frac{1}{p}}$$

which becomes, for p = 1, simply -m/n. The point of inflection is given by solving the equation

$$(157).....P^2 + P(2m + p - 1) + m(m - 1) = 0$$

in which P denotes  $npx^p$ ; this gives:

$$(158)....x_i = \left\{-\frac{2m+p-1\pm\sqrt{[4mp+(p-1)^2]}}{2np}\right\}^{\frac{1}{p}}$$

which, when m = 1 gives the value

$$(159)....x_i = -\left(\frac{1+p}{np}\right)^{\frac{1}{p}} \text{ and also } x_m - (1/np)^{\frac{1}{p}}$$

for the abscissa of the mode.

<sup>&</sup>lt;sup>1</sup> The principle indicated in the preceding note applies, viz., if (a+b+c)/d equals  $(a+\beta+\gamma)/\delta$  approximately, then  $(a+a+b+\beta+c+\gamma)/(d+\delta)$  is sensibly the arithmetic mean.

The integral of a curve can take a number of forms as follows, viz:-

$$(160)... \int y dx = \int x^m e^{nx^p} dx = \frac{x^{m+1}}{m+1} \left\{ 1 + \frac{nx^p (m+1)}{(m+p+1) \, 1!} + \dots + \frac{n^r x^{rp} (m+1)}{(m+rp+1) \, r!} + \dots \right\}; \text{ or }$$

$$(161)... \frac{x^{m+1}}{m+1} e^{nx} \left\{ 1 - \frac{npx^p}{m+p+1} + \frac{(npx^p)^2}{(m+p+1) (m+2p+1)} - \dots + \frac{(-1)^r (npx^p)^r}{(m+p+1) \dots (m+rp+1)} \pm \text{ etc.} \right\}; \text{ or }$$

$$(162)... \frac{x^{m-p+1}}{np} e^{nx^p} \left\{ 1 - \frac{m-p+1}{npx^p} + \frac{(m-p+1) (m-2p+1)}{(npx^p)^2} - \dots + (-1)^r \frac{(m-p+1) \dots (m-rp+1)}{(npx^p)^r} \pm \text{ etc.} \right\}$$

Between the limits 0 and  $\infty$  the integral may be put into the forms of the second Eulerian integral, and is

$$(163) \dots \int_0^\infty x^m e^{-nx^n} dx = \frac{\Gamma\left(\frac{m+1}{p}\right)}{(pn^{\frac{m+1}{p}})}$$

which, when m = o, gives

$$(164)\ldots \int_0^\infty e^{-nx^p}dx = \Gamma\left(\frac{1}{p}\right)/(pn^{\frac{1}{p}})$$

The abscissa,  $x_c$  say, of the *centroid vertical*, or mean of the distribution, is

$$(165)....x_c = \frac{\int x^{m+1} e^{-nx^p} dx}{\int x^m e^{-nx^p} dx} = \frac{\Gamma\left(\frac{m+2}{p}\right)}{\Gamma\left(\frac{m+1}{p}\right)n^{\frac{1}{p}}}$$

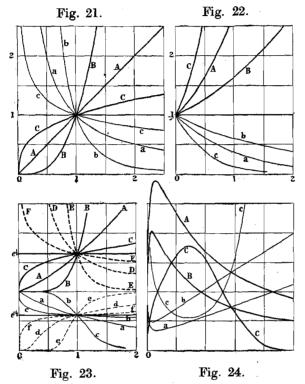
It is sometimes necessary to make the definite integral (163) when multiplied by the coefficient A, equal to unity. In such a case we must have the value of this constant the reciprocal of that given in the value of the integral mentioned, viz. (163); that is

$$(166).....A = pn^{\frac{m+1}{p}} / \Gamma\left(\frac{m+1}{p}\right)$$

Simplications of these general formulæ are often possible.1

<sup>&</sup>lt;sup>1</sup> For a fuller study of this curve, see "Studies in Statistical Representation," by G. H. Knibbs. Jour. Roy. Soc. N.S.W., Vol. XLIV., pp. 341-367; 1910.

The forms of the curves are as shewn on the Figs. 21 to 27. If n in  $e^{nx^p}$  be zero, the curve degrades to  $Ax^m$ , and we have the forms in Fig. 21, in which the capital letters shew the curves when m is positive, and the small letters when m is negative.



If m be zero,  $x^m$  will be unity, and if p also be unity, the curves become  $e^{nx}$ , the forms of which are shewn on Fig.22, the upper lines denoting the values when n is positive and the lower when n is negative.

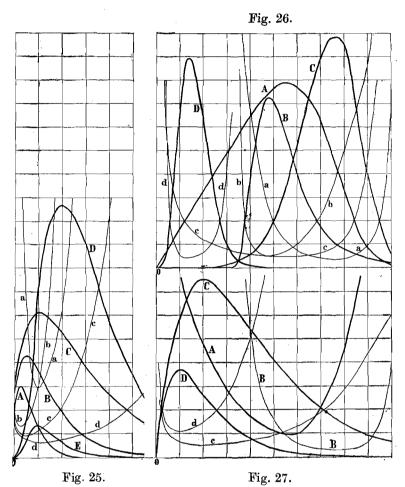
If p, however, be not unity, and p and n be positive, we shall have such forms as A, B, and C on Fig. 23. If p be negative and n positive, the forms become those shewn by the curves D, E, and F in the same figure.

If n be negative and p be positive, the forms become a, b, and c, the reciprocals respectively of curves A, B, and C; and if both n and p be negative, the curves are such as d, e, and f, viz., the reciprocals respectively of curves D, E and F in the same figure, viz., Fig. 23.

Figs. 24 to 27 give values of the curves when both m, n, and p have values other than zero, the light lines denoting the reciprocals of the curves shewn by the heavy lines, and the curves being the following, viz.:

	VALUES OF—								7	Valt	ES (	)F
			m	$\boldsymbol{n}$	$\boldsymbol{p}$						n	-
Fig. 24	A	<i>A</i> =	$\frac{1}{2}$	$-\frac{1}{2}$	$\frac{1}{3}$	Fig. 26		${\bf A}$	=	1	-14	6
,,	I	3 =	1 2	$-\frac{1}{2}$	3						$-\frac{1}{4}$	
,,	(	C =	$\frac{1}{2}$	-1	3	,,		$\mathbf{C}$	=	6	$-\frac{1}{4}$	6
Fig. 25		A =	$\frac{1}{2}$	-2	1	,,	• •	$\mathbf{D}$	=	6	$-\frac{1}{4}$	1
,,	]	B =	$\frac{1}{2}$	<b>~1</b>	1	Fig. 27		$\mathbf{A}$	=	-1	1	6
,,	(	C =	$\frac{1}{2}$	$-\frac{1}{2}$	1	٠,,						
,,,	]	D ==	2	-1	1	,,					-1	
<b>,,</b> ·	]	E . =	<b>2</b>	-2	1	,,	• •	$\mathbf{D}$	=	1	-2	1

In the reciprocal curves, viz., a, b, c, d, etc., the signs of m and n are changed, but not that of p.<sup>1</sup> These will sufficiently illustrate the possible forms of the curve.



6. Generalised probability curves derived from projections of normal curve. In Fig. 28 let bYa denote a normal "error" (or probability) curve, the ordinates of b and a being denoted by corresponding suffixes. If a line be drawn the distance l above OY and parallel thereto (and parallel therefore also to the plane of the curve), it may be represented by the point O' in any plane at right angles to the plane of the curve.

<sup>&</sup>lt;sup>1</sup> It may be mentioned that H. Pélabon, in dealing with the influence of temperature on chemical reactions, developed a relation in the form

 $<sup>\</sup>log y = a + b / x + c \log x;$ 

which, of course, may be written in the form  $y=ab^{-x}x^c$ , which is merely a simple case of formula (149). See Mém. d.l. Soc. des Sciences physiques et naturelles de Bordeaux [5]. 3, pp. 141,257; 1898: Compt. Rend. 124, pp. 35, 360, 686; 1897.

Let a line be drawn from any point, on the curve, viz., a, at right angles to O'. This will be the line O'Q, which, when produced to q on a line VOqU, making the angle  $\theta$  with the line PO, gives the point corresponding to a. The abscissa then may be taken either as Oq or as its orthogonal projection on OP. The latter is more simple. If it be produced to q' on a plane making the angle  $\theta$ ' with the axis OY, it will give a result of greater skewness, see the points  $a_1$  and  $a_2$  in the figure. The scheme of projection will be obvious from the figure, and need not be described in detail.

Let  $\xi$  denote any abscissa on the curve derived by projection, and x the corresponding abscissa on the original curve. Then by similar triangles we have at once the relation of x and  $\xi$  in terms of l and  $\theta$ , inasmuch as

(167)..., 
$$x/l = (\xi - x)/\xi \tan \theta$$
.

This gives, on writing m for  $(\tan \theta) / l$ ,

$$(168).....\xi = x / (1 - mx); x = \xi / (1 + m\xi)$$

from which it is at once evident that the same result may be obtained by any values of l and  $\theta$  whatsoever, which give the same value of m.

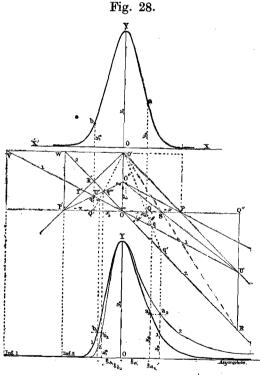


Fig. 29.

Thus, the point S with the projecting height OO'' = l' gives the point U, the orthogonal projection of which Q'' is identical with the result with the projecting height OO' = l, viz., R, as is evident from the figure.

Fig. 29 shews by a heavy line the curve derived from the curve in Fig. 28 by projection on to the plane VOU, and by a thin line the curve similarly derived by projection on to the plane WOR in that figure.

Hence, if for x in the probability-curve equation, we substitute its numerical equivalent, we obtain

(169)..... 
$$y = 1/e^{\frac{\xi^2}{\sigma + 2\sigma m\xi + \sigma \xi^2}} = 1/e^{\frac{\xi^2}{\kappa(\xi + \mu)^2}};$$

 $\kappa$  in the second expression being  $cm^2$ , and  $\mu$  being the reciprocal of m. The curve is asymmetric, since the denominator differs in value according as  $\xi$  is negative or positive. Incidentally we notice that if l be relatively large or  $\theta$  relatively small, m is small, and the asymmetry is not marked; and when l is infinite or  $\theta$  zero, the asymmetry vanishes, as is seen by the projection. In this last expression when  $\xi$  is negative and equal to  $\mu$ , y=0, so that there is a terminal of the curve on the negative side corresponding to  $x=-\infty$ . When  $\tan\theta=l/x$ , then mx=1, and  $\xi$  is infinity; that is to say, the projecting line is parallel to the plane O through the axis. When  $-\xi$  is one-half of -x, then the point with the same ordinate on the positive side is at infinity. This can also be seen on the figure.

This indicates the limitation of the method of projecting onto a plane, namely, that if there is to be a corresponding point at a finite distance on one side of the axis, the abscissæ on the other side cannot be reduced to a greater amount than one-half. This, however, can be overcome by projection on a curved surface. Thus, if projected from the intersections with an equilateral hyperbola orthogonally on to the X axis, from a line parallel to and distant the height l from the Y axis, the Y axis O"H of the hyperbola being the distance p on the negative side, and the X axes, being identical (see Fig. 30) we have

(170)....
$$x = \frac{\xi}{1 - \lambda (p + \xi)}$$
; or  $\xi = x \cdot \frac{1 - \lambda p}{1 + \lambda x}$ 

 $\lambda$  denoting  $p^2/l$ . Hence, substituting the former expression in the ordinary probability curve equation, we obtain

(171)....y = 
$$1/e^{\frac{\xi^2}{\sigma[1-\lambda(p+\xi)^2]}}$$

This gives a terminal to the curve on one side, and an asymptotic relation to the axis on the other, and may be made as skew as we please, as is evident from Fig. 30 and from Fig. 32 giving a projection so derived. A similar scheme of projection using a surface whose right section is a parabola, the abscissa of whose vertex is p (from the origin), and whose equation is  $\eta = g$  ( $\xi - p$ )<sup>2</sup>, gives the result

$$(172)....x = \frac{\xi}{1 + \gamma (\xi - p)^2}$$

in which  $\gamma$  denotes g/l: see Fig. 31. The value of  $\xi$ , therefore, is

(173)..... 
$$\xi = p + \frac{1}{2\gamma x} \{1 \pm \sqrt{[4\gamma x (p-x) + 1]}\}$$

¹ That is, when OQ' is one-half of OP', the corresponding point on the positive side is at infinity.

This gives terminals for both branches of the curve, viz.:-

$$(174).....\xi_{\infty}=p\pm\frac{1}{\sqrt{\gamma}}$$

Since both p and  $\gamma$  may be arbitrarily determined, the position of the terminals of the curve, in relation to the mode, may be made whatsoever we please. Although this leads to a somewhat complicated expression for  $\xi$ , it discloses the character of the curve obtained by projection. Its equation is

(175)....y = 
$$1/e^{\frac{\dot{\xi}^2}{\sigma[1+\gamma(\xi-p)^2]^2}}$$

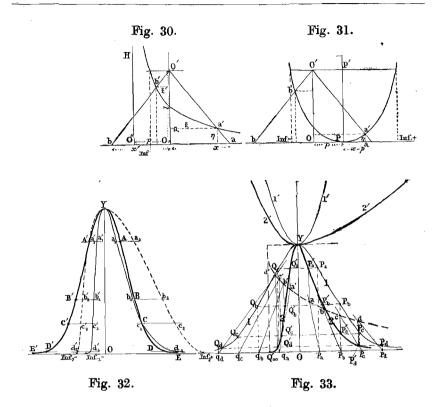
the asymmetry of which is evident. Fig. 30 illustrates the projection on to a surface whose right section is an equilateral hyperbola, and the type of resultant curve with one asymptote is shewn on Fig. 32: see curve  $a_1, b_1, \ldots a_1', b_1' \ldots$ , thereon in a thin firm line, the thick curve A, B,...A', B'... etc., being the probability curve from which it is derived. Fig. 31 is similarly an example of a projection on to a surface whose right section is a parabola, and is shewn on Fig. 32 by a broken line: see curve  $a_2, b_2 \ldots a_2', b_2' \ldots$  etc. The scheme of projection is sufficiently evident from the figures.

Reverting to projection on a plane, it may be noted also the projections may be varied by making l a function of y instead of a constant, as, for example,  $l = ky^n$ , which, writing  $\kappa$  for  $(\tan \theta)/k$ , would give

$$(176)....y = 1/e^{\frac{\xi^2}{\sigma(1+\kappa\xi/y^n)^2}}$$

This does not lead, however, to any simple expression for y in terms of  $\xi$  only. We may notice that since l=0 for y=0, both branches are unlimited (that is to say, the asymptotic relation of the basic curve remains) and the curve is more distant from the X axis than is the basic curve; the curve most closely approaches the type of that with l constant if n be less than unity. If n be negative and numerically greater than unity, we shall have  $\xi$  sensibly equal to x for very small values of y, or  $x=\xi(1-\kappa y^n)$  approximately, and the branches are unlimited.

These projections show that though initially a frequency may be distributed according to the ordinary probability curve, yet the final circumstances may be such that the "frequency is altered in several of its characters," viz., its symmetry, asymptotic relations, etc.



7. Development of type-curves.—A consideration of the form of the equations derived from projections shews that if we put as the fundamental form

(177)....y, or 
$$1/y = y_0/e^{\frac{x^p}{k(1+x/a)^{ma}(1-x/b)^{mb}}}$$

we may include all cases by variations of p, m, k, a and b. When x=0, the value is  $y_0$ , that is to say, the *mode is at the axis*. If a and b, each supposed to be positive, are finite, then for a negative value of x equal to a, or a positive value equal to b, we have y=0, that is the branches of the curve terminate at the axis of abscissa for the negative value of x=a; and for the positive value of x=b. If b be infinite, the curve, which is skew, becomes

(178)....y = 
$$y_0/e^{\frac{x^p}{k(1+x/a)^{ma}e^{-mx}}}$$

and if a be infinite and b finite, the curve is skew, and its equation is

(179)....y = 
$$y_0/e^{\frac{x^b}{ke^{mx}(1-x/b)^{mb}}}$$

If both a and b are infinite, then the preceding curves (178) (179) become

$$(180)....y = y_0/e^{\frac{x^p}{k}}$$

and is symmetric, but if b (or a) be negative, then the curve is

$$(181)....y = y_0/e^{\frac{x^p}{ke^{\mu x}}}$$

This curve is asymmetric<sup>1</sup> and both branches are asymptotic to the axis. The reciprocals of these curves give the other forms required.

8. Evaluation of the constants of the preceding type-curves.—The value of  $y_0$  is assumed to be derived from the data. When all the quantities are divided by the ordinate of the mode, viz., by  $y_0$ , we have a series of reduced values of the ordinates,  $\eta$  say. Then, as a rule, by taking the logarithm twice we can obtain the necessary solution. Thus—

(182)...
$$\eta = e^{f(x)}$$
; hence  $\log \eta = \eta' = f(x)$ ; and  $\log \eta' = \log f(x)$ 

which gives a linear equation. Thus, with the necessary number of values of the ordinate and the corresponding values of the abscissa, a solution of the constants is to hand. If more than the necessary number are given, the least-square method of forming normal equations may be employed. This method will not solve, however (177), (178), or (179), where

(183). 
$$\log \eta' = p \log x - \left\{ \log k + ma \log \left( 1 + \frac{x}{a} \right) + mb \log \left( 1 + \frac{x}{b} \right) \right\}$$

These, however, are very readily solved by expanding the logarithms, and sometimes a and b can be estimated from the graph of the curve.

9. To determine the surface on which the projection of a normal probability-curve will result in a given skew-curve.—From what has preceded, and from Figs. 28 to 32, it is evident that the form and equation of the curved surface, on which the projection of a normal probabilitycurve will furnish any given skew curve, may readily be determined. The problem more generally stated is: -Given two curves to find the surface on which the projection of one will furnish the other. On Fig. 33 let Y. Pd and Y. Qd be the branches of a normal probability curve, and  $YQ'_a \dots Q'_m$ , and  $YP'_a \dots P'_d \dots$  be the branches of a skew-curve, the axis OY being identical for each. Draw radial lines from Y to the orthogonal projections on to the X axis of various points on the normal probability curve, viz., to the points qa, qb, etc., and pa, pb, etc., and from the points Q'a, etc., P'a, etc., whose ordinates to the skew-curve are identical with those of the corresponding points on the normal curve; and draw lines parallel to the axis OY. Then the intersections a, b, etc., a', b', etc., are points on the projection surface. Reference to the figure

<sup>&</sup>lt;sup>1</sup> p is to be understood merely as an operator raising the number in numerical value, but not affecting its sign.

makes the proposition obvious. Thus, the equation to the normal curve being known, that of the skew-curve can be found in the form  $y = 1/e^{f(\xi)}$ , as soon as the equation of the curve of the projection surface is ascertained.

In finding an equation to fit any series of groups the skew-curve may, in practice, be drawn freehand: a suitable normal probability-curve may then be drawn with the same mode and vertical height: the points on the surface found by the method indicated. In general, this will give a somewhat irregular projection-surface, which, however, may ordinarily be so modified as to conform to some geometrical form easily expressible algebraically, from which the requisite formula may then be found. From Figs. 30, 31, and 33 it will be evident how the equation may be ascertained.

10. Reciprocals of curves of the probability-type.—The curve  $\eta = 1/y$ , also of type of practical importance, may similarly be derived by projection from the normal probability-curve: thus

(184).....
$$\eta=1/y=e^{\frac{x^{*}}{c}}$$
, or more generally,  $\eta=e^{\left(\frac{x}{k}\right)^{p}}$ 

that is, its logarithmic homologue is the parabola  $\eta' = \mu x^p$ , in which  $\eta' = \log \dot{\eta}$ , and  $\mu = 1/k^p$ . Thus in Fig. 33 the reciprocal of the normal probability-curve (curve 1) is shewn by the curve marked 1', 1', while the curve 2', 2', is the reciprocal of the curve marked 2, 2. The lateral scale in the figure, however, for curve 2, is four times greater than for curve 1. It will be seen that the type is somewhat similar to the curve of instantaneous rate of mortality according to age.

11. Dissection of multimodal fluctuations into a series of unimodal elements.—It is obvious that any multimodal fluctuation may be analysed into a series of unimodal elements; for example, a series of the form

$$(185)....y = A_0 + A_1 e^{\pm (x-a_1)/o} + ... \dot{A}_r e^{\pm (x-a_r)/or} + ...$$

may, with a sufficient number of terms, be made to fit any continuous curve whatsoever to any assigned degree of accuracy,<sup>1</sup> There is no complete general solution of the problem, however, of dissection. We have already shewn that a dimorphic curve may be the sum or product of two monomorphic curves (see III., § 9, Projective anamorphosis). The difficulties of dissection, however, are not unduly great with graphic methods.

<sup>&</sup>lt;sup>1</sup> See "Contributions to the Mathematical Theory of Evolution" (on the dissection of Asymmetrical and Symmetrical frequency curves, etc.), Prof. Karl Pearson, Phil. Trans., Vol. 185-A, pp. 71-110; 1894.

"Sui massime delle curve disconfishe" Della Curve disconfishe" Della Curve disconfishe

<sup>&</sup>quot;Sui massime delle curve dimorfiche," Dr. F. de Helguero, Biometrika, Vol. III., pp. 84-98, 1904; and also his "Per la risoluzione delle curve dimorfiche," Biometrika, Vol. IV., pp. 230, 231; 1905-6.

<sup>&</sup>quot;Sulla statura degli Italiani," R. Livi, Firenze, 1883. "Die natürliche Auslese beim Menschen," O. Ammon, Jena, 1893.

## V.—GROUP-VALUES, THEIR ADJUSTMENT AND ANALYSIS.

1. Group-values and their limitations.—The data of population statistic are ordinarily given in the form of group-values. For example, in the age-distribution of a population the data are ordinarily in the form of the numbers of persons between the ages x and x+k, x+k and x+2k, and so on, where k may be a month, a year, 5 years, 10 years, etc. Hence, when the number for any group of smaller limits is required, some curve must be assumed which will give the same group-values if the latter are to be regarded as correct.

In other words, if we suppose the numbers between the ages x and x + dx to be  $P\phi(x)$  dx, then the number in the group between the ages x and x + k is

$$(186)..._xN_{x+k}=P\int_x^{x+k}\phi(x)\,dx$$

in which, if P denote the total population of all ages, the value of the integral between the limits 0 and the end of life, say 105 (or  $\infty$ ) is necessarily unity. This is the fundamental conception of the use of group-values. Thus, omitting the coefficient P, the value of the integral between any limits, when its total value is unity, is the proportion of the whole population which lies between the limits in question.

When group-values are known to be subject to error, each group can be modified in amount so as to conform to some distribution regarded as more probable than that furnished by the crude data. Thus, if in the numbers according to age a census return gave for "ages last birthday" 29, 30 and 31, the numbers 20,000; 24,000; 18,000; we should know ordinarily that the number 24,000 was in excess, since the numbers must fall off as the ages increase unless immigration prevent. We deal primarily with the case where the groups are assumed to be correct; having either been corrected, or having been taken accurately.

2. Adjustment of group-values.—In cases where group-values are properly regarded as subject to appreciable error, they should either be first adjusted before the constants of mathematical formulæ representing them are determined, or the computation should be so effected as to automatically make the adjustment a minimum.

The limitations under which group-results are obtained are of two kinds. The results furnished may be either—

- (a) actually subject to large errors; or
- (b) insufficient in number to furnish a truly representative example. For example, misapprehensions as to one's exact age must necessarily have the effect of causing numbers of persons to be attributed to the wrong age-group, thus diminishing some groups and increasing others.

A certain tendency to misstatement is confirmed by census-results, which reveal the fact that ages ending in 0 are characterised by excessively large numbers, and that the numbers for ages ending in 5 are also somewhat excessive, while the numbers for the adjoining years are in defect.

In the other case, limitations in the numbers available prevent one knowing exactly what would have been given had the numbers been indefinitely large. In these latter cases, however, it is often possible to surmise what the curve would have been had the numbers been large, and the actual data may be redistributed so as to conform therewith. In both instances the principle to be followed is that some groups should be so increased, while others should be so diminished as to conform to the most probable distribution which may, for convenience, be called the "ideal distribution."

In effecting these changes in the numbers furnished by the data for individual groups, the alterations should not only be as small as possible, but also the accumulation of the alterations (that is, their algebraic sum) should be alternately plus and minus, and should never become large in amount.

Various considerations may serve as a guide in effecting the alteration: for example, excluding the consideration of deliberate misstatement of age and tendency to uniform error in one direction, the number of cases in which the misstatement of age is one year only is, in general, larger than the number in which the misstatement is two years; and so on. Experience shews also that large positive errors are likely to be made for ages ending in 0; for example, 30, 40, 50, etc.; and lesser positive errors are likely to be made for ages ending in 5; for example, 35, 45, 55, etc., while errors of defect are to be expected in ages 29 and 31, etc., and 34 and 36, etc.

Adjustments are, as a rule, preferably made in the light of a full consideration of all the circumstances affecting the case, and not merely by purely mechanical or merely arithmetical methods.

A redistribution of values may be regarded as excellent when the curve giving the values of the groups is, in the nature of the case, probable, and when at all points it deviates from the successive values of the groups in such wise that the deviation is always relatively small, and the aggregate alternately plus and minus.

3. Representation of group-values by equations with integral indices.—Any curve representing a series of statistical data may be represented by the following expression, viz.,—

$$(187)....y = a + bx^p + cx^q + dx^r + \text{etc.}$$

and, if p, q, r, etc., be not necessarily integral, with a small number of terms. Integrating this we shall have

$$(188).....\int ydx = x(A + Bx^p + Cx^q + Dx^r + \text{etc.})$$
  
in which  $A = a$ ;  $B = \frac{b}{p+1}$ ;  $C = \frac{c}{q+1}$ ;  $D = \frac{d}{r+1}$ ; etc.

When p, q, r, etc., are the successive integers 1, 2, 3, we have for x=0, k, 2k, 3k, etc.

Group. Range of Factors into numbers below the Abscissæ. 
$$a \frac{1}{2}bk \frac{1}{3}ck^2 \frac{1}{4}dk^3 \frac{1}{2}ek^4$$

I.  $0 - k = k (1 1 1 1 1)$ 

II.  $k - 2k = k (1 3 7 15 31)$ 

III.  $2k - 3k = k (1 5 19 65 211)$ 

IV.  $3k - 4k = k (1 7 37 175 781)$ 

V.  $4k - 5k = k (1 9 61 369 2101)$ 

It is easily seen that with integral indices, the above expression of n+1 groups can be fitted by an arbitrary equation of the *n*th degree. Denoting the *heights* of the groups by the small Roman letters i. to v., the heights being found by dividing the group-values by the base k, and the successive differences of height by  $h_0$ ,  $h_1$ , etc., the simplest scheme of solution is to hand in the following series of equations, which are readily obtained by differencing and substitution.

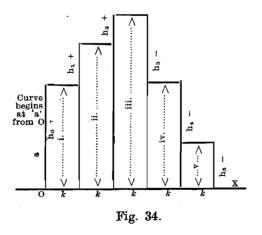
4. Formulæ depending on successive differences of group-heights.—We give first formulae depending merely on the difference of heights, viz., the differences i.-0; ii.-i.; iii.-ii.; etc.; that is, if we denote the successive heights of the groups by

$$(190),\ldots,h_0$$
;  $h_0+h_1$ ;  $h_0+h_1+h_2$ ; etc.,

the successive differences of height will be

$$(191)....h_0$$
;  $h_1$ ;  $h_2$ ;  $h_3$ ; etc.

 $h_0 = i$ , denoting the height of the first group from the X axis, see Fig. 36.1



 $<sup>^{\</sup>rm 1}$  These (191), are the first column of differences if the groups be divided by their base-values viz., by k.

The following, as convenient formulæ for the coefficients a, b, etc., in equation (187), can be deduced, viz.:—

For three groups :--

$$(192)..a = h_0 - \frac{1}{6}(5h_1 - 2h_2); b = \frac{1}{k}(2h_1 - h_2); c = \frac{1}{2k^2}(-h_1 + h_2)$$

For four groups:-

$$(193)....a = h_0 - \frac{1}{12} (13h_1 - 10h_2 + 3h_3)$$

$$(193a)...b = \frac{1}{12k} (35h_1 - 34h_2 + 11h_3)$$

$$(193b)...c = \frac{1}{4k^2} (-5h_1 + 8h_2 - 3h_3)$$

$$(193c)...d = \frac{1}{6k^3} (h_1 - 2h_2 + h_3).$$

For five groups:-

$$(194) \dots a = h_0 - \frac{1}{2} h_1 + \frac{1}{60} (-47h_1 + 86h_2 - 51h_3 + 12h_4)$$

$$(194a) \dots b = \frac{1}{k} \left\{ h_1 + \frac{1}{12} (33h_1 - 64h_2 + 41h_3 - 10h_4) \right\}$$

$$(194b) \dots c = \frac{1}{8k^2} (-17h_1 + 37h_2 - 27h_3 + 7h_4)$$

$$(194c) \dots d = \frac{1}{6k^3} (3h_1 - 8h_2 + 7h_3 - 2h_4)$$

$$(194d) \dots e = \frac{1}{24k^4} (-h_1 + 3h_2 - 3h_3 + h_4).$$

If instead of heights we use group-values, the quantities found, say a', b', c', etc., will be k times those above given, and must be reduced accordingly

5. Formulæ depending on the group-heights themselves.—Instead of using the difference of the group-heights, the coefficients of the equation may be expressed in terms of the successive group-heights themselves, found by dividing the group-numbers by the value of the common interval along the abscissa; that is, by dividing the integrals between the successive limits having a common interval k, by that quantity. It will be sufficient to give the results for from three to five groups. These results are:—

For three groups:—
$$(195) \dots a = \frac{1}{6} (11i. - 7ii. + 2iii.)$$

$$(195a) \dots b = \frac{1}{k} (-2i. + 3ii. - iii.)$$

$$(195b) \dots c = \frac{1}{2k^2} (i. - 2ii. + iii.)$$

For four groups:-

$$(196) \dots a = \frac{1}{12} (25i. - 23ii. + 13iii. - 3iv.)$$

$$(196a) \dots b = \frac{1}{12k} (-35i. + 69ii. - 45iii. + 11iv.)$$

$$(196b) \dots c = \frac{1}{4k^2} (5i. - 13ii. + 11iii. - 3iv.)$$

$$(196c) \dots d = \frac{1}{6k^3} (-i. + 3ii. - 3iii. + iv.)$$

For five groups:-

$$(197) \dots a = \frac{1}{60} (137i. - 163ii. + 137iii. - 63iv. + 12v.)$$

$$(197a) \dots b = \frac{1}{12k} (-45i. + 109ii. - 105iii. + 51iv. - 10v.)$$

$$(197b) \dots c = \frac{1}{8k^2} (17i. - 54ii. + 64iii. - 34iv. + 7v.)$$

$$(197c) \dots d = \frac{1}{6k^3} (-3i. + 11ii. - 15iii. + 9iv. - 2v.)$$

$$(197d) \dots e = \frac{1}{24k^4} (1 - 4ii. + 6iii. - 4iv. + v.)$$

If the aggregate numbers or group-values are used, instead of the heights, the denominators will be 1/k,  $1/k^2$ ...... $1/k^5$  instead of those above.

6. Formulæ depending upon the leading differences in the groups or in group-heights.—It is often convenient in practice to work with differences instead of the group-values or of heights. In the latter case the coefficients are similarly given by the following equations:—

The coefficients of equation (187) expressed in terms of successive leading differences of the group-heights are:—

$$(198)....a = \frac{1}{1} \left( i. -\frac{1}{2} D_1 \right| + \frac{1}{3} D_2 \right| -\frac{1}{4} D_3 \right| + \frac{1}{5} D_4$$

$$(198a)...b = ... \frac{1}{k} \left( D_1 \right| - D_2 \right| + \frac{11}{12} D_3 \right| -\frac{5}{6} D_4$$

$$(198b)...c = ... \frac{1}{k^2} \left( \frac{1}{2} D_2 \right| -\frac{3}{4} D_3 \right| + \frac{7}{8} D_4$$

$$(198c)...d = ... \frac{1}{k^3} \left( +\frac{1}{6} D_3 \right| -\frac{1}{3} D_4$$

$$(198d)...e = ... \frac{1}{k^4} \left( \frac{1}{24} D_4 \right)$$

In the above  $D_1$ ,  $D_2$ ,  $D_3$ , and  $D_4$  are the leading differences of the heights only, viz., of i., ii....v. As before, if the group values are subtracted, without first dividing by k, the denominators should be 1/k,  $1/k^2$ ..... $1/k^5$ , instead of those above given. Formulæ (198) to (198d) are correct for any number of groups up to five, the division lines on the right hand side shewing the results for two, three, four and five groups.

7. Determination of differences for the construction of curves. — When the equation of the curve is to hand, it is often required to find values of the ordinates corresponding to a series of values of the abscissa. This is most conveniently effected by obtaining the successive leading differences: from these the required values can be obtained. These are:—

It may be remarked that when k=1 these difference values become

(200) ..... 
$$D_1 f(0) = D_1 i$$
.  $-\frac{1}{2} D_2 i$ .  $+\frac{1}{3} D_3 i$ .  $-\frac{1}{4} D_4 i$ .  
(200a) .....  $D_2 f(0) = D_2 i$ .  $-\frac{1}{2} D_3 i$ .  $+\frac{1}{3} D_4 i$ .  
(200b) .....  $D_3 f(0) = D_3 i$ .  $-\frac{1}{2} D_4 i$ .  
(200c) .....  $D_4 f(0) = D_4 i$ .

in which the symbol  $D_1i$ ,  $D_2i$ , etc., denotes the leading differences derived from the series from i., ii., iii., etc.

8. Cases where position of curve on axis of ordinates has a fixed value. —In the equation (187) it may happen that the curve is required to pass through the intersection O of the axes OX, OY; or at a fixed distance therefrom on the Y-axis. In this instance the solutions given are invalid, inasmuch as a is initially given, not determined from the group-values. The most convenient procedure is to subtract this value a from the heights i., ii., iii., etc., of the ordinates, or the value ka from the

group-values (or areas) I., II., III., etc. This procedure gives new values, viz., y' = y - a, and the solution required is then of the successive integrals (group values) divided by k.

$$(201).....\frac{1}{k}\int y'dx=\frac{1}{k}\int (bx+cx^2+\text{ etc.})\ dx$$

that is, of  $\frac{1}{2}bx + \frac{1}{3}cx^2 + \text{etc.}$ 

It is obvious that in this instance n groups will require an equation of the nth degree, instead of, as before, of the (n-1)th, the imposed condition of a fixed value for a involving this limitation.

The following formulæ give the value of the constants in terms of the heights.

For two groups, curve passing through origin,

$$(202).....b=\frac{1}{2k}\ (7{\rm i}\ -{\rm ii})\,;\quad c=\frac{1}{4k^2}(\ -\ 9{\rm i}\ +3{\rm ii})$$
 For three groups, curve passing through origin,

$$(203)....b = \frac{1}{18k} (85i - 23ii + 4iii)$$

$$(203a).....c = \frac{1}{2k^2} (-10i + 5ii - iii)$$

$$(203b)....d = \frac{1}{9k^3} (11i - 7ii + 2iii)$$

For four groups, curve passing through origin,

$$(204).....b = \frac{1}{72k} (415i - 161ii + 55iii - 9iv)$$

$$(204a).....c = \frac{1}{96k^2} (-755i + 493ii - 191iii + 33iv)$$

$$(204b).....d = \frac{1}{36k^3} (119i - 97ii + 47iii - 9iv)$$

$$(204c).....e = \frac{1}{288k^4} (-125i + 115ii - 65iii + 15iv)$$

For five groups, curve passing through origin,

$$(205)...b = \frac{1}{1800k}(12019i - 5981ii + 3019iii - 981iv + 144v)$$

$$(205a)..c = \frac{1}{32k^2}(-343i + 273ii - 155iii + 53iv - 8v)$$

$$(205b)..d = \frac{1}{360k^3}(2149i - 2111ii + 1429iii - 531iv + 84v)$$

$$(205c)...e = \frac{1}{96k^4}(-133i + 147ii - 113iii + 47iv - 8v)$$

$$(205d)...f = \frac{1}{1200k^5}(137i - 163ii + 137iii - 63iv + 12v.)$$

The constants in the terms of the leading differences of the heights are :— $^{1}$ 

For two groups, curve passing through origin,

$$(206)....b = \frac{1}{k} (3i - \frac{1}{2} D_1 i)$$

(206a) ....
$$c = \frac{1}{k^2} \left( -\frac{3}{2} i + \frac{3}{4} D_1 i \right)$$

For three groups, curve passing through origin,

$$(207).....b = \frac{1}{k} \left( \frac{11}{3} i - \frac{5}{6} D_1 i + \frac{2}{9} D_2 i \right)$$

(207a) .... 
$$c = \frac{1}{k^2} \left( -3i + \frac{3}{2} D_1 i - \frac{1}{2} D_2 i \right)$$

(207b).... 
$$d = \frac{1}{k^3} \left( \frac{2}{3} i - \frac{1}{3} D_1 i + \frac{2}{9} D_2 i \right)$$

For four groups, curve passing through origin,

$$(208)....b = \frac{1}{k} \left( \frac{25}{6}i - \frac{13}{12}D_1i + \frac{7}{18}D_2i - \frac{1}{8}D_3i \right)$$

(208a) ....
$$c = \frac{1}{k^2} \left( -\frac{35}{8}i + \frac{35}{16}D_1i - \frac{23}{24}D_2i + \frac{11}{32}D_3i \right)$$

(208b) .... 
$$d = \frac{1}{k^3} \left( \frac{5}{3}i - \frac{5}{6}D_1i + \frac{5}{9}D_2i - \frac{1}{4}D_3i \right)$$

(208c) .... 
$$e = \frac{1}{k^4} \left( -\frac{5}{24}i + \frac{5}{48}D_1i - \frac{5}{72}D_2i + \frac{5}{96}D_3i \right)$$

For five groups, curve passing through origin,

$$(209)...b = \frac{1}{k} \left( \frac{137}{30} i - \frac{77}{60} D_1 i + \frac{47}{90} D_2 i - \frac{9}{40} D_3 i + \frac{2}{25} D_4 i \right)$$

(209a) .. 
$$c = \frac{1}{k^2} \left( -\frac{45}{8}i + \frac{45}{16}D_1i - \frac{11}{8}D_2i + \frac{21}{32}D_3i - \frac{1}{4}D_4i \right)$$

(209b) 
$$..d = \frac{1}{13} \left( \frac{17}{6} i - \frac{17}{12} D_1 i + \frac{17}{18} D_2 i - \frac{13}{24} D_3 i + \frac{7}{30} D_4 i \right)$$

(209c) 
$$..e = \frac{1}{k^4} \left( -\frac{5}{8}i + \frac{5}{16}D_1i - \frac{5}{24}D_2i + \frac{5}{32}D_3i - \frac{1}{12}D_4i \right)$$

$$(209\text{d}) \ ... f = \frac{1}{k^5} \left( \ \frac{1}{20} \ \mathbf{i} - \frac{1}{40} D_1 \mathbf{i} + \frac{1}{60} D_2 \mathbf{i} - \frac{1}{80} D_3 \mathbf{i} + \frac{1}{100} D_4 \mathbf{i} \right)$$

<sup>&</sup>lt;sup>1</sup> i denotes the height of the first group-result;  $D_1 i = ii - i$ ;  $D_2 i = iii - 2ii - i$ ;  $D_3 i = iv - 3iii + 3iii - i$ ; etc.; that is, they are the *leading* differences.

9. Determination of group-values when constants are known.—When the equation is in the form (187), p, q, r, etc., being 1, 2, 3, etc., the most ready way to compute a series of values of groups 0 to k, k to 2k, 2k to 3k, etc., is to form the leading differences, and from these the successive values of the groups can be readily formed. The following formulæ give the required result:—<sup>1</sup>

When the equation is of a less degree than the fifth, zeros can be substituted for the coefficients; thus for a fourth degree, f=0; for a third degree f=0 and e=0; and so on; and the formulæ still hold good.

10. Curve of group-totals for equal intervals of the variable expressed as an integral function of the central value of the interval.—If we have a series of group-totals for equal intervals of the abscissa, as, for example, for 0 to k, k to 2k, etc., and if those values divided by the common interval are represented by the ordinates at  $\frac{1}{2}k$ ,  $1\frac{1}{2}k$ ,  $2\frac{1}{2}k$ , etc., to a curve the equation of which is an integral function of the type of formula (187), then, whatever be the value of x in this equation, the ordinate for the point x will give very approximately the group-total for  $x - \frac{1}{2}k$  to  $x + \frac{1}{2}k$ . That is to say, denoting the ordinate to the curve representing the groups  $x \pm \frac{1}{2}k$  by Y, and that to the curve representing the original function by y, if

(211)..... 
$$Y = F(x + \frac{1}{2}k) = y \int_{x}^{x+k} dx = \int_{x}^{x+k} f(x) dx$$

for the values x=0, 1, 2, etc., then it follows that very approximately

$$(212).....F(x+\frac{1}{2}k+q)=\int_{x+q}^{x+k+q}f(x)\,dx$$

provided that the forms of F and f are the same, that is, that they are both integral functions of a single variable. This result is important, and may be established by the following consideration.

If we compute  $F(x) = \int f(x) dx$  so that the two are in agreement for  $x = \frac{1}{2}k$ ,  $1\frac{1}{2}k$  and  $2\frac{1}{2}k$ , in the first function, with the limits 0 to k, k to 2k, and 2k to 3k in the second, then it is easy to establish that if the original

<sup>1</sup>  $D_1I.$ ,  $D_2I.$ , etc., denote the series of leading differences, viz. (III. -2II. + I.); (IV. -3III. + 3III. - I.); etc.

equation be  $a+bx+cx^2$ , and if the equation for the group-total, divided by the common interval, be  $A+Bx+Cx^2$ , when x is the value of the abscissa for the middle of the interval, then

(213)..... 
$$A = a + \frac{1}{12}ck^2$$
;  $B = b$ ;  $C = c$ .

If we extend the solution to the third power of x, that is, extend the limits to  $3\frac{1}{2}k$  and 3k to 4k respectively, we have

(214)..... 
$$A = a + \frac{1}{12} ck^2$$
;  $B = b + \frac{1}{4} dk^2$ ;  $C = c$ ;  $D = d$ .

If we further extend the solution to the fourth power of x, and the limits to  $4\frac{1}{2}k$  and 4k to 5k respectively, we obtain

(215). 
$$A = a + \frac{1}{12}ck^2 + \frac{1}{80}ek^4$$
;  $B = b + \frac{1}{4}dk^2$ ;  $C = c + \frac{1}{2}ek$ ;  $D = d$ ;  $E = e$ .

If the fifth power of the variable be included, that is, the limits be  $5\frac{1}{2}k$  and 5k to 6k respectively, then

(216).. 
$$A=a+\frac{1}{12}ck^2+\frac{1}{80}ek^4$$
;  $B=b+\frac{1}{4}dk^2+\frac{1}{16}fk^4$ ;  $C=c+\frac{1}{2}ek^2$ ;  $D=d+\frac{5}{6}fk^2$ ;  $E=e$ ;  $F=f$ .

It will be observed that up to the second power of the variable, the effect is that A differs from a only by a constant, consequently the function F gives rigorously the correct result, viz., that given by integrating the function f. For powers higher than the second, the result is true only for  $k=\frac{1}{2}$ ,  $l\frac{1}{2}$ , etc., in F, and for any other values is more or less in error. This error cannot, in general, however, attain appreciable magnitude, because it is repeatedly reduced to zero at intervals of k, viz., at the values of the abscissa,  $\frac{1}{2}k$ ,  $l\frac{1}{2}k$ , etc.

In practical statistical examples the coefficients b, c, d, e, f, etc., are generally in diminishing order of magnitude, and we see from the equations (213) to (216) that the corresponding numerical factors also rapidly diminish; hence the difference between the rigorous value  $\int f(x) dx$  and the approximate value F(x) must generally be very small, and, by the formulæ given, can be readily tested in any numerical examples.

11. Average values of groups.—An average value  $\boldsymbol{y}_r$  of a group is the quantity

$$(217).....y_{r} = \frac{1}{x_{2} - x_{1}} \int_{x_{1}}^{x_{2}} y dx$$

in which y denotes the value of the ordinate, and  $x_1$  to  $x_2$ , the range of the variable. Reverting to formulæ (187) and (188), and retaining the same meaning for the constants, the mean value of the range x to x + k is

(218)...
$$y_r = A + \frac{1}{k} [B\{(x+k)^{p+1} - x^{p+1}\} + C\{(x+k)^{q+1} - x^{q+1}\} + \text{etc.}]$$

which takes a simpler form if p, q, r, etc., are 1, 2, 3, etc. Where x has a series of values 0, k, 2k, etc., as in (189) the averages are given by omitting the factor k in the formulæ. More generally, that is, for any value of x and k we have

$$(219).....y_{r} = a + b\left(x + \frac{k}{2}\right) + c\left(x^{2} + xk + \frac{1}{3}k^{2}\right) + d\left(x^{3} + 1\frac{1}{2}x^{2}k + xk^{2} + \frac{1}{4}k^{3}\right) + e\left(x^{4} + 2x^{3}k + 2x^{2}k^{2} + xk^{3} + \frac{1}{5}k^{4}\right)$$

For groups bounded by curves of the exponential type we may note that

$$(220)\ldots a^x = e^{x \log a} = e^{mx}$$

Thus, the rate of change at any point of the curve  $y = ne^{mx}$  is

$$(221)\ldots \frac{dy}{dx} = d (ne^{mx})/dx = mne^{mx}$$

and the mean rate  $y_m$  is

$$(222)....y_m = mne^{mx}.\frac{e^{mk}-1}{mk}$$

that is, this is the mean ordinate to the curve.

If the ordinates for the beginning, middle, and end of any range of values of the abscissa, that is, if the ordinates corresponding to the values x,  $x+\frac{1}{2}k$ , and x+k, are to hand, and the group-values are the integral of an equation of the type (199), then the value of  $y_r$  is

$$(223)...y_{r} = \frac{1}{6}(y_{x} + 4y_{m} + y_{x+k}) - \frac{1}{24}k^{4} \left\{ \frac{1}{5}e + f(x + \frac{1}{2}k) + 3g(x^{2} + xk + \frac{23}{84}k^{2}) + \text{etc.} \right\}$$

The negative term (in braces) is absolutely negative, x being positive, if e, f and g are positive, and it is usually so small as to be negligible. When x=0 and k=1, the value of (223) takes the very simple form

$$(224)....y_r = \frac{1}{6}(y_0 + 4y_m + y_k) - \frac{1}{24}\left(\frac{1}{5}e + \frac{1}{2}f + \frac{23}{28}g\right)$$

 $y_m$  denotes, of course, the middle ordinate.

This result is important, because it shews that group-values can be calculated with considerable precision by the "prismoidal formula" if we have middle as well as terminal instantaneous values of each group.

# VI.—SUMMATION AND INTEGRATION FOR STATISTICAL AGGREGATES.

- 1. General.—In effecting statistical summations, regard is to be had to two elements, viz.:—
  - (i.) Order of accuracy significant in the case in point;
  - (ii.) Arithmetical consistency of results.

Curves drawn freehand among data, that represent either groups or instantaneous results, and which shew visible variations, can, for some purposes, be integrated with sufficient precision by careful graphing and the use of a planimeter. When arithmetical smoothing has followed graphic, in order to enhance the accuracy, numerical calculations are virtually required as being of corresponding precision. As a rule group values (or the total area between any ordinates, the curve, and the axis of abscissæ) can, if the ordinates are relatively near each other, be computed by means of the prismoidal, Simpson's, Weddle's and similar rules. Finally, for work of the highest precision, actual integrations by the method of the infinitesimal calculus are required. In general, however, the precision then far transcends that of the data.

The extension of *implied* precision far beyond that of the data is seen in all actuarial tables: this matter is referred to later, since the year change in probability of life is a quantity of a much larger order than that to which results are expressed.

2. Areal and volumetric summation formulæ.—Statistics relating to population involve both areal and volumetric summations. The latter can, however, always be represented by an areal graph. If the curve represent instantaneous and not group-values² about a particular value of the variable, then the areal value can be computed without computing the equation of the curve and integrating it.

It has been shewn<sup>3</sup> that if an axis be equally divided, that is, if x=0, k, 2k...nk, and the curve passing through the terminals of the ordinates (y) from these points is assumed to be represented by an integral function of x, then suitable multipliers or weights may be determined, which, applied to the ordinates, will give the area. If there be an

$$\int y dx$$
;  $\frac{1}{2} \int y^2 dx$ ;  $\frac{1}{3} \int y^3 dx$ ;  $\frac{1}{4} \int y^4 dx$ 

that is, the area, the statical moment, the moment of inertia, and the cubic moment about the axis x. No mechanical integrator, however, can possibly approximate to the precision attainable by arithmetic.

<sup>&</sup>lt;sup>1</sup> Amsler's Integrator will cover a considerable area, and gives in the one operation (on four cylinders and discs) the values of following integrals, viz.:—

<sup>&</sup>lt;sup>2</sup> That is, represents the frequency y, for a given value x of the variable and not the group-mean for  $x - \frac{1}{2}k$  to  $x + \frac{1}{2}k$ . See V., 10.—Curves representing group-totals, formula (211) to (216).

<sup>&</sup>lt;sup>3</sup> See "Volumes of solids as related to transverse sections," by G. H. Knibbs, Journ. Roy. Soc. N.S.W., Vol. XXXIV., pp. 36-71, 1900. See Prop. (O), p. 70.

odd number of equidistant ordinates the curve may be of the same degree as the number of ordinates, viz., (n+1); if the number of ordinates be even, the degree of the curve must be one less than that number (n).

It has been shewn also that if the curve bounding the area is of a less degree than that satisfied by the number of ordinates, then there is one-fold, two-fold,....k-fold infinity of multipliers which will exactly give the area, according as the degree of the curve is 1, 2, .... k less than the number of ordinates.<sup>1</sup>

The formulæ can be readily constructed, and are exhibited in the table hereunder.<sup>2</sup> The significance of this table may be indicated as follows:—

When n+1 equidistant ordinates are given for a curve of the *n*th degree, there is only one system of weights that will give the integral correctly between the limits 0 and n. In the table this system is indicated in each case above by an asterisk (\*). Further, when n is even, the unique series of weights, applicable to n+1 equidistant ordinates, is also applicable to a curve of the (n+1)th degree, but this is not true when n is odd.

When n+2 equidistant ordinates are given for a curve of the nth degree, any value whatever may be assigned to one of the weights (say  $w_0$ ), and the corresponding values of the other weights may be expressed in terms of  $w_0$ . In this case there is evidently an infinite number of possible systems of weights, each of which will give the integral accurately for a curve of the nth degree. In the foregoing table the systems of this nature are indicated by a dagger (†), the coefficient (i.e., 1) of the arbitrarily selected weight being shewn in heavy type. As an example, there may be taken the case in which seven equidistant ordinates of a fifth degree curve are given. Here the weightings shewn by the table are  $w_0 = w_0$ ;  $w_1 = 3.3 - 6w_0$ ;  $w_2 = -4.2 + 15w_0$ ;  $w_3 = 7.8 - 20w_0$ ;  $w_4 = -4.2 + 15w_0$ ;  $w_5 = 3.3 - 6w_0$ ;  $w_6 = w_0$ .

If  $w_0$  be given the value 0.3 this series becomes  $\frac{3}{10} \left(1, 5, 1, 6, 1, 5, 1\right)$ , which will be recognised as Weddle's rule.

Similarly, when n+3 equidistant ordinates are given for a curve of nth degree, two weights may be arbitrarily selected and the remaining n+1 may be computed in terms thereof, thus admitting of a two-fold infinity of systems of weighting. In the foregoing table systems of this nature are indicated by a double dagger (‡).

Similarly, when n+4 ordinates are given for a curve of the *n*th degree there is a three-fold infinity of systems, when n+5 ordinates are given, a four-fold infinity, or, in general, when r ordinates are given for a curve of the *n*th degree there is an (r-n-1)-fold infinity of systems of weighting.

 $<sup>^{1}</sup>$  Ibid, § 16, pp. 60-71. Examples of the development of k-fold infinity of multipliers are given on pp. 64-67.

<sup>&</sup>lt;sup>2</sup> Prepared by Mr. C. H. Wickens, A.I.A.

Series of Weights for Ordinates with same Suffix	Value of the Weights when the curve passing through their Terminals is a function of the—										
with same Suffix	2nd degree.	3rd degree.	4th degree.	5th degree.	6th degree.	7th degree.					
3 Ordinates  W <sub>0</sub> W <sub>1</sub> W <sub>2</sub>	$\begin{pmatrix} 1\\4\\1 \end{pmatrix} \times \frac{1}{3}$	$\begin{pmatrix} 1\\4\\1 \end{pmatrix} \times \frac{1}{3}$									
4 Ordinates    W   0	$\begin{cases} 9 \\ 3 \\ 3 \\ 4 \\ -1 \end{cases} \times \frac{1}{4} = \frac{3}{3}$	$\left\{\begin{array}{c} 1\\3\\3\\1\end{array}\right\} \times \left\{\begin{array}{c} 8\\3\\\end{array}\right\}$									
5 Ordinates    W_0	$ \begin{array}{c}  & & & \\  & & & \\  & & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  & & \\  &$	$\begin{bmatrix} & & & & & \\ -\frac{8}{4} & & & & \\ -\frac{4}{8} & & & & \\ & & & & \\ & & & & \\ & & & & $	$\begin{pmatrix} 7\\ 32\\ 12\\ 32\\ 7 \end{pmatrix} \times \frac{2}{45}$	$\begin{pmatrix} 7\\ 32\\ 12\\ 32\\ 7 \end{pmatrix} \times \frac{2}{45}$							
6 Ordinates    W_0     W_1     W_2     W_3     W_4     W_5	$ \begin{array}{c}                                     $	$ \begin{array}{c}  & \downarrow \\  & 1 \\  & 1 \\  & -325 \\  & -325 \\  & 275 \\  & -55 \end{array} \right\} \times \begin{array}{c}  & -10-4 \\  & 20 \\  & 6 \\  & 24 \\  & -15 \\  & 4 \end{array} $	$\begin{pmatrix} 425 \\ -350 \\ 600 \\ -50 \\ 95 \end{pmatrix} \times \frac{1}{144} - \frac{10}{5} \\ -1$	$ \begin{array}{c} 19\\75\\50\\50\\75\\19 \end{array} \times \frac{5}{288} $							
7 Ordinates    W_0	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{vmatrix} 33 \\ -42 \\ 78 \\ -42 \\ 33 \end{vmatrix} \times \begin{vmatrix} -6 \\ 15 \\ 10 \\ -20 \\ 15 \\ -6 \\ 1 \end{vmatrix} $	$\begin{pmatrix} 41\\216\\27\\272\\272\\27\\216\\41 \end{pmatrix} \times \frac{1}{140}$	$\begin{pmatrix} 41\\ 216\\ 27\\ 272\\ 272\\ 216\\ 41 \end{pmatrix}  imes rac{1}{140}$					

The significance of the \*, †, and ‡ is referred to in the text.

3. The value of groups in terms of ordinates.—It is often convenient to ascertain the value of groups between certain limits of a variable. If the ordinates be supposed to conform to the equation a+bx; or  $a+bx+cx^2$ , etc., etc., we can construct a series of equations which are rigorously true under the particular supposition, and may be regarded as approximations in the general case. By comparing the expression for the integral between assigned limits with the values of the ordinates, we deduce the following expressions for the heights of the groups in terms of the ordinates.

TABLE VII.

Values of Group Heights for Different Ranges of the Variable in Terms of the Ordinates to the Curve.

2nd Approximation. Formulæ (229) to (232).

Ranges of Integral 
$$0-\frac{1}{2}$$
  $\frac{1}{2}-1$   
Semi- group-heights  $\frac{1}{12} (8y_0 + 5y_1 - y_2)$ ;  $\frac{1}{12} (2y_0 + 11y_1 - y_2)$   
Ranges of Integral  $1-1\frac{1}{2}$   $1\frac{1}{2}-2$   
Semi-group-heights  $\frac{1}{12} (-y_0 + 11y_1 + 2y_2)$ ;  $\frac{1}{12} (-y_0 + 5y_1 + 8y_2)$ 

3rd Approximation. Formulæ (233) to (236).

$$\begin{array}{lll} \text{Ranges of Integral} & 0 \cdot \frac{1}{2} & \frac{1}{2} \cdot 1 \\ \text{Semi-group-} & \frac{1}{192} \left( 119 y_0 + 107 y_1 - 43 y_2 + 9 y_3 \right); & \frac{1}{192} \left( 25 y_0 + 197 y_1 - 37 y_2 + 7 y_3 \right) \\ \text{Ranges of Integral} & 1 \cdot 1 \frac{1}{2} & 1 \frac{1}{2} \cdot 2 \\ \text{Semi-group-} & \frac{1}{192} \left( -9 y_0 + 155 y_1 + 53 y_2 - 7 y_3 \right); & \frac{1}{192} \left( -7 y_0 + 53 y_1 + 155 y_2 - 9 y_3 \right) \\ \text{heights} & \end{array}$$

4th Approximation. Formulæ (237) to (240).

Ranges of Integral. Semi-group-heights.

$$(237)..... 0_{-\frac{1}{2}} = \frac{1}{2880} (1694y_0 + 1969y_1 - 1191y_2 + 499y_3 - 91y_4)$$

$$(238)..... \frac{1}{2}-1 = \frac{1}{2880} (314y_0 + 3199y_1 - 921y_2 + 349y_3 - 61y_4)$$

$$(239).....1-1\frac{1}{2} = \frac{1}{2880} \left(-91y_0 + 2149y_1 + 1059y_2 - 281y_3 + 44y_4\right)$$

$$(240).....1_{\frac{1}{2}}-2 = \frac{1}{2880}(-61y_0 + 619y_1 + 2589y_2 - 311y_3 + 44y_4)$$

1st Approximation. Formulæ (241) to (243).

Ranges of Integral 0-1 
$$\frac{1}{2}$$
-1 $\frac{1}{2}$  1-2 Group-heights  $\frac{1}{2} (y_0 + y_1)$   $y_1$   $\frac{1}{2} (-y_0 + 3y_1)$ 

2nd Approximation. Formulæ (244) to (246).

Ranges of Integral 0-1 
$$\frac{1}{2}$$
  $\frac{1-1}{2}$  1-2 Group-heights  $\frac{1}{12}(5y_0 + 8y_1 - y_2); \frac{1}{24}(y_0 + 22y_1 + y_2); \frac{1}{12}(-y_0 + 8y_1 + 5y_2)$ 

3rd Approximation. Formulæ (247) to (249).

Ranges of Integral.

$$(247).....0-1 = \frac{1}{24} (9y_0 + 19y_1 - 5y_2 + y_3)$$

$$(248).....\frac{1}{2}-1\frac{1}{2}=\frac{1}{24}(y_0+22y_1+y_2+0y_3)$$

$$(249)......1-2=rac{1}{24}(-y_0+13y_1+13y_2-y_3).$$

4th Approximation. Formulæ (250) to (252).

Ranges of Integral.

$$(250)..... 0-1 = \frac{1}{720} (251y_0 + 646y_1 - 264y_2 + 106y_3 - 19y_4)$$

$$(251)..... \frac{1}{2} - 1\frac{1}{2} = \frac{1}{5760}(223y_0 + 5348y_1 + 138y_2 + 68y_3 - 17y_4)$$

$$(252).....1_{\frac{1}{2}}-2 = \frac{1}{720} \left(-19y_0 + 346y_1 + 456y_2 - 74y_3 + 11y_4\right)$$

In applying these formulæ the actual common-range of the interval on the axis of abscissæ is immaterial; that is, we may read throughout 0 to  $\frac{1}{2}k$ ;  $\frac{1}{2}k$  to k etc.; instead of 0 to  $\frac{1}{2}$ ;  $\frac{1}{2}$  to 1; etc.; the ordinates  $y_0$ ,  $y_1$ , etc., being taken of course 0, k, 2k, 3k, etc. By these formulæ, therefore, we may halve groups.

It will be noticed that the coefficients are always symmetrically opposed for semi-groups standing in the same relation to the ordinates; for example, with two ordinates, 0 to  $\frac{1}{2}$  is the same form as  $\frac{1}{2}$  to 1; with three, 0 to  $\frac{1}{2}$  agrees with  $1\frac{1}{2}$  to 2, and  $\frac{1}{2}$  to 1 with 1 to  $1\frac{1}{2}$ ; with four ordinates, the only symmetrically opposed pair are 1 to  $1\frac{1}{2}$  and  $1\frac{1}{2}$  to 2. From this it is evident that, for the third and fourth approximations the formulæ for the remaining group-heights within the limits of the ordinates

used can be written down by inspection. Thus for the 3rd and 4th approximations the group-heights of the various semi-groups are as follow:—

#### 3rd Approximation.

The ordinates for the semi-group  $2\frac{1}{2}$  to 3 are the inverse of those for 0 to  $\frac{1}{2}$  ..., ...,  $\frac{1}{2}$  to 1 ..., ...,  $\frac{1}{2}$  to 2 ..., ...,  $\frac{1}{2}$  to 1 (as already given).

4th Approximation.

The ordinates for the semi-group  $3\frac{1}{2}$  to 4 are the inverse of those for 0 to  $\frac{1}{2}$ 

,,	,,	,,	3 to $3\frac{1}{2}$	,,	,,	,,	$\frac{1}{2}$ to 1
,,	,,	,,	$2\frac{1}{2}$ to $3$	,,	,,	,,	$1  ext{ to } 1\frac{1}{2}$
,,	,,	,,	2 to $2\frac{1}{2}$	2,9	,,	,,	$1\frac{1}{2}$ to $2$

4. The value of group-subdivisions in terms of groups.—It is often required to divide a group. Practically we may always halve a group and halve again if necessary. If we divide groups with a common interval (k) on the axis of abscissæ we may, with advantage, use the group-height (g) instead of the group number G; that is, we may use g = G/k. Then we obtain the following series of formulæ, which, like the last, are rigorously accurate if the groups are given by the integrals of the equation a+bx;  $a+bx+cx^2$ ; etc.; etc. They may therefore be regarded, as in the previous instance, either as a series of approximations, or as rigorously accurate, according as they represent exactly or approximately the subdivisions of groups given by the integral equations referred to.

### TABLE VIII.

Values of Group-heights for different half-ranges of the variable in terms of the heights of successive whole groups.

1st Approximation. Formulæ (253) to (256).

Ranges of integral 0-
$$\frac{1}{2}$$
  $\frac{1}{2}$ -1  $1$ - $1\frac{1}{2}$   $1\frac{1}{2}$ -2 Semi-group-heights  $\frac{1}{4}$  (5 $g_1$ - $g_2$ );  $\frac{1}{4}$  (3 $g_1$ + $g_2$ );  $\frac{1}{4}$  ( $g_1$ +3 $g_2$ );  $\frac{1}{4}$  ( $-g_1$ +5 $g_2$ )

2nd Approximation. Formulæ (257) to (260).

$$\begin{array}{lll} \text{Ranges of integral} & 0 - \frac{1}{2} & \frac{1}{2} - 1 \\ \text{Semi-group-heights} & \frac{1}{8} \left( 11 g_1 - 4 g_2 + g_3 \right) \, ; & \frac{1}{8} \left( 5 g_1 + 4 g_2 - g_3 \right) \\ \text{Ranges of integral} & 1 - 1 \frac{1}{2} & 1 \frac{1}{2} - 2 \\ \text{Semi-group-heights} & \frac{1}{8} \left( g_1 + 8 g_2 - g_3 \right) \, ; & \frac{1}{8} \left( - g_1 + 8 g_2 + g_3 \right). \end{array}$$

4th Approximation. Formulæ (265) to (268).

Ranges of integral.

Semi-group-heights.

$$(265).....0_{-\frac{1}{2}} = \frac{1}{128} (193g_1 - 122g_2 + 88g_3 - 38g_4 + 7g_5)$$

$$(266).....\frac{1}{2} - 1 = \frac{1}{128} (63g_1 + 122g_2 - 88g_3 + 38g_4 - 7g_5)$$

$$(267).....1_{-\frac{1}{2}} = \frac{1}{128} (7g_1 + 158g_2 - 52g_3 + 18g_4 - 3g_5)$$

$$(268).....1_{-\frac{1}{2}} - 2 = \frac{1}{128} (-7g_1 + 98g_2 + 52g_3 - 18g_4 + 3g_5)$$

The opposite symmetry of the coefficients for semi-groups in symmetrically opposed positions, having regard to the total number of groups in question, is obvious, as in the case for ordinates. The same remarks apply, *mutatis mutandis*, as those made regarding the coefficients of the ordinates.

5. Approximate computation of various moments.—In connection with the application of the method of moments in statistical investigations of distribution (population and other) it is often necessary to compute moments from available data. This can also be done from the available ordinates in the following manner:—

It is obvious that the curved boundary of any group, covering a limited range of the variable, can be represented with considerable precision by a curve of the second degree: see V., § 11, formulæ (217) to (224). Let the group-height be denoted by g, that is, let g denote the group-area divided by k, that is, the group-range on the axis of abscissæ. If g' and g'' are the ordinates to the curve for  $a-\frac{1}{2}k$  and  $a+\frac{1}{2}k$  respectively, and g be the central ordinate, viz., at the distance g from the intersection of the axes, and if g be the distance of the mean of the terminals g' and g'' from the terminal of this central ordinate, that is, if g and g'' hen the group-height is given by the equation

$$(269)...g = \frac{1}{2} (y' + y'') + \frac{2}{3} h = \frac{1}{6} (y' + 4y_a + y'')$$

and the equation to the curve is-

$$(270)\dots y = y_a + \frac{y'' - y'}{k}(x-a) + \frac{4h}{k^2}(x-a)^2 = y_a + b(x-a) + c(x-a)^2$$

the origin being at the distance a from the ordinate  $y_a$ . This curve is regarded as valid only for the group to which it applies, and not for adjoining groups. From this last equation we can compute the successive moments,  $M_0$  denoting the area,  $M_1$  the statical moment,  $M_2$  the moment of inertia, and  $M_3$  the moment of the fourth order.

It is important to attend to the signs of b and c. If y''-y' is positive, that is, if the ordinate is increasing in the direction of  $a+\frac{1}{2}k$ , then b is plus; and c is plus if the curve is convex upward; that is, if b is positive.

Thus the several moments are :--

$$(271).....M_{0} = k (y_{a} + \frac{1}{12} ck^{2}) = k (y_{a} + \frac{1}{3} h)$$

$$(272).....M_{1} - aM_{0} = \frac{1}{12} bk^{3} = \frac{1}{12} k^{2} (y'' - y')$$

$$(273).....M_{2} - 2aM_{1} + a^{2}M_{0} = \frac{1}{60} k^{3} (5y_{a} + 3h)$$

$$(274).....M_{3} - 3aM_{2} + 3a^{2}M_{1} - a^{3}M_{0} = \frac{1}{80} k^{4} (y'' - y')$$

and may be very readily computed from these formulæ, which are rigorously exact on the supposition made, and will be sensibly correct generally.

6. Statistical integrations.—Ordinarily, statistical data are subject to considerable error and uncertainty, and meticulous precision in regard thereto is, therefore, usually unmeaning. The approximations of statistical technique itself, should, however, aim at a somewhat higher order of accuracy than that characteristic of the data, in order that the error should not prejudicially accumulate through mere computational vitiation. The great majority of cases of integration occurring in ordinary statistical practice will be found to have been solved. Valuable tables of integrals are available.<sup>1</sup>

<sup>1 (</sup>i.) Sammlung von Formeln der reinen und angewandten Mathematik. W. Láska, Braunschweig, 1888-1894, pp. 1-1071.

<sup>(</sup>ii.) Tafeln unbestimmter Integrale. G. Petit-Bois, Leipzig, 1906.

<sup>(</sup>iii.) Een Aanhangsel tot de Tafels van onbepaalde Integralen. D. Bierens de Haan.

<sup>(</sup>iv.) Exposé de la théorie des propriétés, des formules de transformation, et des méthodes d'évaluation des Intégrales définies, partie 1, pp. 1-82; partie 2, pp. 83-181; partie 3, pp. 183-698. Bierens de Haan, Amsterdam, 1860.

<sup>(</sup>v.) Nouvelles Tables d'intégrales définies. Bierens de Haan, 5 parties, pp. 1-733. Engels, Leide, 1867.

The integrals of curves of the type of (20), II., § 19, are sometimes required: that is,—

$$(275).....\int a (bx)^{\pm m \pm nbx} dx = \frac{a}{b} \int y^{\pm m \pm ny} dy = A \int y^m e^{ny \log y} dy$$
$$= A \int e^{(\pm m \pm ny) \log y} dy$$

in which A = a/b; and y = bx. This last form may be expressed by an exponential series. Or

(276)...
$$f(y^{m+ny})dy = f(y^m)\{1 + ny \log y + \frac{1}{2}(ny \log y)^2 + \dots\}dy$$
 which may be integrated term by term. Again

$$(277)... f x^{nx} dx = x \left\{ 1 - \frac{nx}{2^2} + \frac{n^2 x^2}{3^3} - \frac{n^3 x^3}{4^4} + \ldots \right\} + \frac{nx^2 \log x}{1!} \left\{ \frac{1}{2} - \frac{nx}{3^2} + \frac{n^2 x^2}{4^3} - \ldots \right\}$$

$$\frac{n^2 x^3 (\log x)^2}{2!} \left\{ \frac{1}{3} - \frac{nx}{4^2} + \frac{n^2 x^2}{5^3} + \ldots \right\} + \text{ etc.}$$

Similarly, forms of the type of formula (32a), see II., § 23

$$(278).....fx^{\frac{1}{(\pm m \pm nx)^{\nu}}}dx = fe^{\frac{\log x}{(\pm m \pm nx)^{\nu}}}dx$$

can, if m and n be regarded as positive, be put in the form

$$(279)....\int \left\{1 + \frac{\log x}{(m+nx)^p} + \frac{(\log x)^2}{2!(m+nx)^{2p}} + ... + \frac{(\log x)^k}{k!(m+nx)^{kp}} + ...\right\} dx$$

which can be integrated term by term. The integrals, however, are tedious. For example:—

$$(280). \int \frac{\log x}{(m+nx)^{p}} dx = \frac{\log x}{(p-1)n\phi^{p-1}} + \frac{1}{(p-1)mn} \left\{ \frac{1}{(p-2)\phi^{p-2}} + \frac{1}{(p-3)m\phi^{p-3}} + \frac{1}{(p-4)m^{2}\phi^{p-4}} + \dots + \frac{1}{2m^{p-4}\phi^{2}} + \frac{1}{m^{p-5}\overline{\phi}} \right\} + \frac{1}{(p-1)m^{p-1}n} \log \frac{x}{\overline{\phi}}$$

 $\phi$  denoting  $(m+nx)^p$ .

If p = 1, and n is positive, this takes the simpler form—

$$(281)..../x^{\frac{1}{m+nx}} = \frac{1}{n} \log x \log (m+nx) - \frac{1}{2n} (\log nx)^2 \frac{m}{n^2x} - \frac{m^2}{2^2n^3x^2} + \frac{m^3}{3^2n^4x^3} + \text{ etc.}$$

Owing to the very great elaboration of the terms of many of the integrals, practically it is preferable to compute a sufficient number of ordinates, and integrate by any suitable summation-formula (given hereinbefore).

7. The Eulerian integrals or Beta and Gamma functions.—The Beta and Gamma functions are of special importance in statistical integrations. They are:—

$$\int_{0}^{1} x^{l-1} (1-x)^{m-1} dx = \int_{0}^{1} z^{m-1} (1-z)^{l-1} = \int_{0}^{\infty} \frac{y^{l-1} dy}{(1+y)^{l+m}} = \int_{0}^{\infty} \frac{y^{m-1} dy}{(1+y)^{l+m}}$$

that is, in the more brief notation-

(283).....B 
$$(l, m) = B(m, l) = \frac{\Gamma(l) \Gamma(m)}{\Gamma(l+m)}$$

Further—

$$(284)..\int_{0}^{\infty} e^{-x} x^{n-1} dx = \int_{0}^{1} \left( \log \frac{1}{y} \right)^{n-1} dy = (n-1) \int_{0}^{\infty} e^{-x} x^{n-2} dx = \Gamma(n)$$

respectively, from which it is evident that:—1

$$(285)....\Gamma(1) = 1; \Gamma(n+1) = n! = n\Gamma(n)$$

Thus, in order to calculate  $\Gamma(n)$  we have, if it be an integer, it is equal to (n-1)!, if not an integer, it can be readily found, since its logarithms have been tabulated for the range 1 to 2 to two places of decimals and to 9 places of figures.<sup>2</sup> Thus—

$$(286)....n (n + 1) (n + 2)....(n + k - 1) \Gamma(n) = \Gamma(n + k)$$

which, logarithmically, is perfectly convenient to use.

By putting kz = x, in (284), it becomes obvious that

$$(287)........f_0^{\infty}e^{-kx}x^{n-1}dx = \frac{\Gamma(n)}{k^n}$$

$$(288)\ldots \frac{d}{dn}\Gamma(n) = \Gamma'(n) = \int_0^\infty e^{-x} x^{n-1} \log x \, dx.$$

Examples of the application of these formulæ have already been given: see IV., § 5, formulæ (150) to (166).

8. Table of indefinite and definite integrals and limits.—In an addendum small tables are given, for convenience, of indefinite integrals; of definite integrals, for example, between limits such as zero and unity; zero and infinity; etc., and of limiting values. These embrace those which more frequently occur in statistical investigations.

 $<sup>\</sup>Gamma(\frac{1}{2}) = \sqrt{\pi}$ .

<sup>&</sup>lt;sup>2</sup> Traité des Fonctions Elliptiques, Legendre, Paris 1825-8 (logarithms to 12 places). Sammlung von Formeln, W. Láska, pp. 290-1. Braunschweig (logarithms to 9 places). Biometrika, J. H. Duffell, Vol. VII., 1909-10, pp. 43-7 (logarithms to 7 places).

# VII.—THE PLACE OF GRAPHICS AND SMOOTHING, IN THE ANALYSIS OF POPULATION-STATISTICS.

1. General.—Graphs of the data are necessary in any analysis of population-statistics purporting to aim at thoroughness. A graph indicates not only the general trend of the data, but also whether the individual items conform with great exactitude to that trend, or whether they deviate considerably therefrom. The criticism of deviations ordinarily depends upon whether numbers or ratios are being analysed. Where figures are of the nature of ratios, if, on the working-graphs the numbers be written, it is possible to see at a glance whether changes in any part of the graph of the crude data are significant or otherwise. Thus a ratio resulting from 30,000 divided by 10,000 would be materially changed so far as the numerical data are concerned by an alteration, say, of one-thousandth. To change the ratio say from 3 to 2.997 would mean an alteration of 30 in the numerator or of 10 in the denominator; whereas, if the original data were the numbers 3 and 1, an alteration of a single unit would greatly disturb the ratio.

In general, we are concerned with two kinds of alteration; one may be called the "redistribution of the data without alteration of their aggregate;" and the other may be called the "alteration of data to coincide with what is deemed the most probable result," having regard to all the facts. It is, for example, sometimes desirable to keep the aggregate of the smoothed results identical with that of the data. In other cases this is less essential, and it may be said that probably much time is often wasted in making re-distributed data agree with the original as to the aggregate of units represented.

As to general method it may be noted that when the original facts have been plotted, a curve may be drawn freehand by anyone familiar with the characteristics of the various type-curves, and especially those of probability-curves. By means of sets of curves, French curves, and splines of various kinds,\* the freehand curves may then be improved so as to be really smooth and conform to what might be called the probable indication of the data. When the numbers represented are large, limitations of scale may operate to limit the smoothness as deduced by scaled values, from the graphs, but a little simple differencing will suggest necessary adjustments, or the differences may be graphed. The adjustments having been made, the aggregate can be formed by adding together the scaled or properly differenced ordinates thus adjusted.

If this operation has been well done the total will be so nearly in agreement with the original data that a common factor of correction can be used throughout, that is, all the ordinates may be increased or diminished in the same ratio, and the finally deduced ordinates will then agree

<sup>\*</sup> Splines of transparent celluloid are most convenient.

with the data, and at the same time form a smooth curve. If the data when plotted are visibly irregular, meticulous precision in adjustment is obviously but a waste of time. For this reason one of the great merits of the graphic method is that, not only can the analyst see at a glance the conformity or otherwise of the data to a particular type of curve, but he can also judge whether the data yield results of a high order of precision.

It has already been mentioned (see IV., § 1) that the initial and terminal characters of the curve and its mode (maximum and minimum) are important. It may be added, that if the curve is not drawn as unimodal in type, the reason for the adoption of a particular form must really depend on the character of the data, and may not be decided merely upon mathematical considerations.

2. The theory of smoothing statistical data.—It may often be known a priori that phenomena should exhibit a regular progression, and that data, when graphed, shewing as zig-zag lines, do not really represent the ideal fact, owing either to the paucity of the data, or to unavoidable error therein.

In a series of group-values, i.e., totals or aggregates between a series of limits of a variable, it is important to bear in mind that—assuming the counts on which they depend to be correct—what is known is merely the series of aggregates themselves: the probable distribution yielding these aggregates has to be conjectured. When the totals or aggregates are themselves regarded as subject to error, then the distribution may be modified within the limits of probable uncertainty, some groups being diminished and others, particularly adjoining ones, increased.

There are four principal classes of data to which the process of curve-smoothing is applicable. These may be indicated as follows:—

- (i.) Frequencies of a phenomenon at successive epochs or during successive periods of time; as, for example, population estimates at given dates and numbers of deaths occurring during successive years.
- (ii.) Rates of occurrence of a phenomenon per unit of reference during successive periods; as, for example, birth-rates per thousand of population per annum for successive years.
- (iii.) Frequencies in respect of successive values of characters capable of continuous variation; as, for example, the number of persons at each age recorded at a given census.
- (iv.) Rates of occurrence of a phenomenon per unit of reference in respect of successive values of characters susceptible of continuous variation; as, for example, rates of mortality per unit per annum during a given decennium in respect of each age.

In all these cases the characteristic of continuous variation<sup>1</sup> is assumed to exist either actually or virtually. Where statistical results are *discontinuous* such a process is, strictly speaking, inapplicable; as, for

example, in the tabulation of census population according to birthplace, occupation, or religion. In some cases, however, although the data are strictly speaking discontinuous, the principle may be applied partially; for example, in the case of a tabulation of dwellings according to number of rooms or according to number of inmates. In such cases the character possessed is *progressive without being continuous*; nevertheless, with proper qualifications, the smoothing principle may be applied even to these.

Another example, more nearly approaching but not attaining continuous variation, is the representation of dwellings according to rental value.

- 3. Object of smoothing.—From the foregoing it will be seen that the data to which the smoothing process is strictly applicable are those which may be regarded as functions of a continuous variable. But whether such functions are readily expressible by means of algebraic formulæ or not, is, of course, really immaterial. The essence of the matter is that in any instance the data are in the main such as admit of representation by means of a continuous line, or a continuous surface or solid in relation to continuous units of reference. When such representation has been made of the crude results of observation, it is ordinarily found that the line surface or solid exhibits evidences of marked irregularities as between adjacent points or series of points, their general trend, however, suggesting an underlying basis of orderly progression. This progression is, of course, affected by minor influences operating at individual points, and is more or less masked by the paucity of the data on which the representation has been based; thus, suggesting further that were it possible to obtain data of unlimited extent, these irregularities would become negligible. For this reason the object of the smoothing process may be said to be that of removing these apparently accidental irregularities, and of thus disclosing the basic or ideal uniformity which may be presumed to represent the facts in all their generality.
- 4. Justification for smoothing process.—The justifications for the smoothing process may thus be said to be:—
  - (a) That the irregularity does not represent the phenomenon in its generality, since much of the observed irregularity is known a prior to be due only to paucity of data;
  - (b) or that it is known that the phenomenon subject to observation is really regular;
  - (c) or, again, that the observed data suggest that regularity of trend will not efficiently represent them.

It has been objected that any system of smoothing is, strictly speaking, unwarrantable, since such a process virtually attempts to make the facts accord with more or less questionable preconceptions regarding them. To this view it may be rejoined that if the process were such as to produce results which, though smooth, differed systematically and materially in their distribution from the original observations, the objection would be valid. Where, however, due consideration is given to the

relative magnitudes of the original data, and the smoothed results accord therewith as closely as the data will allow when these exhibit a general trend, then the only preconception that can be regarded as operative is the justifiable one that ordinarily natural phenomena do not progress per saltum. In this connection it must be noted that where there is distinct evidence at any stage of a cataclysmic disturbance of results, the smoothing process for such points or periods will usually be invalid or not properly applicable. Examples of such cataclysmic disturbances of statistical data are war, famine, pestilence, earthquake, etc. Even in these cases, however, it appears admissible under certain circumstances to apply a smoothing process; as, for example, in cases where the disturbances referred to are of more or less frequent occurrence, and are not merely isolated instances.

One of the most cogent justifications for the smoothing process has its warrant in the fact that the recorded results of any statistical observations are necessarily approximative, and hence that the value of the function recorded for any given value of the variable is probably not usually more accurate than an estimate based on the recorded values in respect of preceding and succeeding values of the variable. This consideration suggests the idea of weighting successive observations to obtain most probable values, which idea forms the basis of one of the leading methods of adjustment. Again, where the results of the observations are to be employed as guides to future action, it is clear that these results should, as far as practicable, be freed from all fluctuations which may be considered merely accidental, and thus unlikely to be reproduced in future experience. This is of considerable importance in connection with the construction of mortality and sickness, superannuation, and similar tables to be used in the computation of rates of premium, and for the conduct of valuations.

5. Mode of application of smoothing processes.—It has already been indicated that one of the main objects of the smoothing process is the discovery of a smooth series which presumably underlies the irregular data furnished by a limited number of observations, and it has been implied that a process to be justifiable must, in addition to smoothness, be characterised also by what has been called "goodness of fit"; that is, within reasonable limits it must reproduce the characteristic features of the original data.

The methods of applying the smoothing process which have up to the present been employed, may conveniently be grouped in three classes, viz.:—(a) Graphic Methods; (b) Summation Methods; and (c) Methods of Functional Conformity.

These methods have been employed in connection with observations in many fields of research; as, for example, general statistics, actuarial science, physics and chemistry, astronomy, tidal theory, biology, etc. In the actuarial field, an extensive and systematic use of the process has been made, and a most detailed examination of the underlying principles has been carried out.

(a) Graphic method.—As its name indicates, this method is based on the attainment of the desired smoothness by means of a graphical representation and adjustment of the observed data. For example, the subject of observation being the infantile mortality experienced in a community during a given period, and the periods of observation being calendar years, a base line is taken and divided into equal parts, each of which represents a year. On these parts as bases a series of rectangles is constructed, the area of each rectangle being proportional to the rate of infantile mortality averaged for the corresponding year. The upper parts of these rectangles will present in the case supposed the appearance of flights of steps with uniform treads and unequal rises. The necessary smoothing may be effected by drawing a continuous free-hand curve through the upper portions of these rectangles in such a manner as to include between certain limits the same area approximately as is contained in the rectangles covering the same range.1 The area enclosed by the part of the base line relating to any year, the ordinates drawn from the extremities of this part, and the portion of the curve between these ordinates will represent the smoothed result for the year under review. Whether, as in the example just given, the data should be represented by areas, or, as is sometimes more suitable, by ordinates, is a matter which is determined agreeably to the appropriate interpretation of the result to be attained. It may be noted that the method of representation by rectangular areas is specially applicable to cases where the data are functions not of single values of the variable, but of ranges of such values. For instance, in the above example, the rate of infantile mortality stated for any year is a function not of any one point of time in that year, but of the range of values representing the whole of the year. In most cases, however, the system of representation by means of ordinates would be equally valid, and sometimes more convenient.<sup>2</sup> Referring again to the above example, from a point on the base line representing the end of each year an ordinate could be drawn representing the rate of infantile mortality for that year, and a free-hand curve being drawn amongst the upper points of these ordinates, the ordinate to any point on the curve would represent the rate of infantile mortality for the year ending on the date corresponding to the foot of the ordinate. Similarly, the ordinate for smoothing might be drawn from the beginning or the middle of the line for each year, or, indeed, from any point uniformly selected in each, and a corresponding interpretation of any point taken on the curves drawn amongst the upper points of such ordinates would be applicable.

6. On smoothing by differencing.—A curve continually convex (or continually concave) upward might possibly be drawn with a single difference. We have, by the theory of differentiation—

(289). 
$$.dy/dx = d(a+bx^p+cx^q+\text{ etc.})/dx = pbx^{p-1}+qcx^{q-1}+\text{ etc.};$$

<sup>&</sup>lt;sup>1</sup> In practical examples it is rarely possible to make the curve such that the adjusted areas are continually identical with the rectangles on the same base.

<sup>&</sup>lt;sup>2</sup> See, however, V., § 10, formulæ (212) to (216).

hence, if p, or q, etc., should happen to be *integers*, at some stage of differentiation, this particular term of the expression will be  $x^0=1$ , and hence that difference will vanish. Probably in no case are population-statistical results actually representable by integral values of p, q, etc., hence, strictly, there is no limit to the series of differences. These, however, ultimately become high negative powers of x, and consequently when x is large their value is small; they must ultimately become of negligible amount.

Again, statistical data often involve exponential forms, particularly those of the type  $ae^{-nx}$ , the differential of which is  $-nae^{-nx}$ , from which it is evident the successive differences are interminable. Since, however,  $de^{-x}/dx = 1/e^x$ , the higher differences for large values of x become insensible. Hence, we shall always be justified in taking differences only to the stage where they are appreciable. Thus if at any stage of smoothing we make the second difference a constant, we are making the curve one which the equation  $y=a+bx+cx^2$  will reproduce; if we go on then with a constant third difference, we add a stretch of a new curve, viz.,  $y'=a'+b'x+c'x^2+d'x^3$ ; and so on. Such methods are unobjectionable when the tangents to the curve at the point of junction may be regarded as sensibly identical.

7. Effect of changing the magnitude of the differences.—It is often useful to be able to recognise instantly the consequence of changing the magnitude of a difference. This can be indicated at once by a table.

Table IX.—Effect on the value of a function of a change of a unit in a leading difference.

Difference in which		Effect on the value of $y$ where its suffix is—										
the change takes place.			1	2	3	4	5	6	7	8	9	10
1st difference		0	1	2	3	4	5	6	7	8	9	10
2nd difference		0	0	1	3	6	10	15	21	28	36	45
3rd difference	• •	0	0	0	1	4	10	20	35	56	84	120
4th difference		0	0	0	0	1	5	15	35	70	126	210
5th difference		0	0	0	0	0	1	6	21	56	126	252

It will be recognised that these are the figures of Pascal's triangle taken diagonally, or the diagonal series in this are the figures of Pascal's triangle taken vertically. By means of such a table one can see at a glance the effect on any value of the function of changing a leading difference.

8. Smoothing, by operations on factors.—The smoothing of a succession of ordinates or of group-values may often advantageously be effected not by operating upon these numbers themselves, but upon their ratios to each other. This may be called factorial smoothing. Let A, B, C, D, etc., be the series of quantities to be smoothed. The ratios B/A, C/B, D/C, etc., are formed, and denoted by b, c, d, etc. These are graphed and smoothed by any process.\(^1\) The smoothed values, denoted by b', c', d', etc., are then used to form a new series of quantities; thus A=A, Ab'=B''; B''C'=C'', etc. The sum of these is then made equal to the sum of the original series of quantities by a common factor k, thus—

(290). 
$$k = \frac{A+B+C+D+\text{ etc.}}{A+Ab+Abc+Abcd+\text{ etc.}} = \frac{A \left\{1+b\left[1+c\left\{1+d\left(1+\ldots\right)\right\}\right]\right\}}{A \left\{1+b'\left[+c'\left\{1+d\left(1+\ldots\right)\right\}\right]\right\}}$$

then the smoothed values A', B', etc., are A' = kA; B' = kAb'; C' = kAb'c'; D' = kAb'c'd'; etc.

Sometimes, on taking out the ratios, it becomes evident that they should have a common value, since they show no systematic progression. In such a case, let m denote the mean value, then the denominator A + Ab + Abc + etc. in (290) becomes  $A + Am + Am^2 +$  etc.

Smoothing of this kind is serviceable for initial and terminal values.

- 9. Logarithmic smoothing.—In a similar manner quantities may sometimes be advantageously smoothed by smoothing their logarithms. In this connection we bear in mind that if a series of numbers are in geometrical progression their logarithms are in arithmetical progression. Let  $\log A$ ,  $\log B$ , etc., be denoted by  $\alpha$ ,  $\beta$ , etc., which are graphed, and when smoothed denoted by  $\alpha'$ ,  $\beta'$ , etc. If the sum of A'', B'', etc., corresponding to the smoothed values, do not agree with that of the original values, k will be the factor of correction, and may be found as before, that is, by (290). This process may be called logarithmic smoothing, and like factorial smoothing, is often useful for initial and terminal values.
- 10. On the difference between instantaneous and grouped results.—When instantaneous results are smoothed the resulting smooth curve represents the equation which reproduces the values of y corresponding to given values of the abscissæ. When, however, group-results are smoothed by differencing, the resultant curve strictly represents the value of a group of the same base (supposed, of course, constant) with any central value throughout the range smoothed: see V., § 10. When, however, group results are few in number (that is, have relatively large bases) the graph must be drawn upon a different principle, viz., it must, as far as the probabilities of the case will admit, make the areas between bounded by the curve, the abscissæ, and the ordinates identical with the

<sup>&</sup>lt;sup>1</sup> Arithmetically, i.e., by difference, or mechanically, by splines, etc.

area of the group, or, in other words, the mean height of all the ordinates to the curve in any given range of the abscissa must be equal to the height of the group. That is, if h is the height of the group, then :-

$$(291)....h = \frac{1}{x_2 - x_1} \int_{x_1}^{x_2} f(x) dx.$$
  $f(x)$  denoting the smoothed curve drawn.

This method may be called "the method of equivalent group-values," and it will, in general, either not depend on differencing at all, or depend thereon to a less extent than when the bases are relatively smooth and the groups numerous.

11. Determination of the exact position and height of the mode.— It is often desirable to ascertain with such precision as is possible the abscissa and height of the mode. Two approximate solutions are desirable, viz. :—(a) when the graph shews that three groups should be taken into consideration; and (b) when four groups. In the former case (a) the formulæ are extremely simple; in the latter (b) they are much less so. If more than four groups are to be taken into consideration it is better to determine the general equation of the curve and solve to obtain that value of x which makes dy/dx=0. As an approximate solution will be available from the graph, there is usually very little difficulty in obtaining an exact value of x. Then the corresponding value of y can be found from the equation: see V., §§ 3 to 7.

Case (a). In Fig. 35 let K denote the mean of the heights of the groups on either side of the maximum group and the height of this last, and let k be half the difference of the height of the groups on either side. Let also a denote the difference of the height of one group and the greatest group, and  $\beta$  similarly the difference of the height of the other group and the greatest group. Then

$$(292)...K = \frac{1}{2} (a+\beta); \text{ and } k = \frac{1}{2} (a \sim \beta).$$

Then a second degree curve, giving the same group values, gives the abscissa of the mode:-

(293).....
$$\mu = \frac{a}{a+\beta}$$
; and  $\mu' = \frac{\beta}{a+\beta}$  and the height  $\lambda$ , of the mode, above the maximum group is

$$(294)....\lambda = \frac{1}{12} K + \frac{1}{4} \frac{k^2}{K}$$

If f, g, and h denote the heights of the rectangles we should have for the constants of the curve-

(295)..... 
$$a = \frac{1}{6} (11f + 2h - 7g)$$
  
(295a) ....  $b = 3g - 2f - h$   
(295b) ....  $c = \frac{1}{2} (h + f) - g$ 

the base of the curve being considered unity.

In the case (b), differences of height being as shewn in Fig. 36 the constants of the curve which must now contain  $dx^3$  will be

(296)... 
$$a = \frac{1}{12}(\gamma + \gamma'); \ b = \frac{1}{12}(15\beta - \delta'); \ c = -\frac{3}{12}(\gamma + \gamma');$$

$$d = -\frac{2}{12}(3\beta - \delta')$$

a being reckoned from the point K, half-way between A and B to the point L, that is, to the curve.

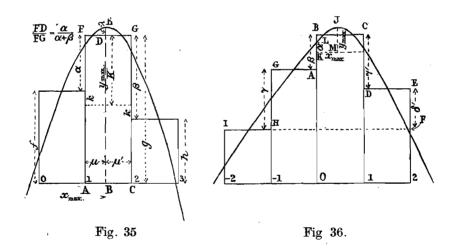
The value of the abscissa of the mode is given by

$$(297)..x_{m} = -\frac{\gamma + \gamma'}{2(3\beta - \delta')} \left\{ 1 \pm \sqrt{\left(1 + \frac{2}{3} \cdot \frac{(15\beta - \delta')(3\beta - \delta')}{(\gamma + \gamma')^{2}}\right)} \right\}$$

The sign of the term under the radical can readily be determined in a practical example. The general expression for  $y_m$  is lengthy. In cases practically occurring we may compute it from  $x_m$  when that value is found: that is, it is

$$(298)...y_{m} = \frac{1}{12} \left\{ \gamma + \gamma' (1 - 3x_{m}^{s}) + (15\beta - \delta') x_{m} - 2(3\beta - \delta') x_{m}^{s} \right\}$$

the ordinate being reckoned from the line parallel to the axis of abscissæ and half-way between the points A and B in Fig. 36, i.e., the line MJ in the figure.



The formulæ (293) and (294) and (297) and (298) are not quite satisfactory, and in general it is better to compute the coefficients of the equation which fits a considerable stretch of the curve, and find the position of the maximum by dy/dx = 0, if very great precision be required.

- 12. The testing of smoothed or graphic results.—When smoothed graphed results are obtained they will, in general, need, as already indicated, to be arithmetically tested. The fundamentals of arithmetical testing are the following:—
  - (i.) The sum of the graphed results should be sensibly (or exactly) equal to the sum of the original data;
  - (ii.) The deviations, positive and negative, between the aggregate of the smoothed results and the data up to each given value of the argument should, consistently with the type of curve adopted, be a minimum;
  - (iii.) The position and ordinate of the mode should be carefully fixed, and as well as the data will permit;
  - (iv.) The position of the terminals should conform to the probabilities of the type of data so far as that can be determined.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> In general, they cannot be determined mathematically. For example, the frequency of births of given ages, so far as mathematical relations are concerned, might be continued to start at the age 0, but in view of physiological considerations we should not be justified in starting at 0, but at, say, the age 11; similarly in regard to the terminal, which may be made to meet the axis of abscissæ for age 60 (or such later age as may be indicated as occurring, should satisfactory information be to hand).

#### VIII.—CONSPECTUS OF POPULATION-CHARACTERS.

1. General.—Thus far the consideration of the theory of population has been concerned only with its numerical aspect, and with the mathematical form of expressions under which it may be necessary to subsume the facts. These constitute an essential preliminary only. It remains now to consider in detail some of the various characters of importance.

Not only are population-statistics, in the narrower sense, significant both (i.) in themselves, and (ii.) in comparison, but so also are all facts that may properly be regarded as expressions of the various characteristics of a population. Following the nomenclature of biology, these may be called more briefly its *characters*. Such characters may relate to—

- (a) Vital phenomena, that is, to birth, life and death, to reproduction in all its aspects, to disease and all the modes of its incidence;
- (b) Anthropometry, that is, may relate merely to the human form and its variations, or to its growth and decrepitude,
- (c) Anthropology, that is, they may refer to man's general evolution, both physical and psychical;
- (d) Sociology, that is, they may concern man in respect of his social life, an important element in which is his economic evolution, and they may concern also the reaction of this upon his numbers and the density of his aggregation.
- (e) Migration, aggregation, segregation, or wide dispersion, colonisation, etc., that is, the direction and velocity of movement of populations, the tendency to live in more or less dense groups (large cities or villages) or to spread over the earth,

All these have significance in regard to the rate of development of the world's people. It is well to bear in mind, also, that populationcharacters may be in two forms, viz., either actual or potential.

The importance of the subject is seen in the impossibility of maintaining the present rate of increase for any great length of time (see II., § 34); and its range of subjects is best seen through a conspectus. Characters may be simple or complex, their manifestation may be instantaneous or durational; and the evidence of their nature direct or derivative. The greatness of the range of population-characters, and the number of significant relations subsisting among them is so vast that no statistical presentation of them can be exhaustive. Thus important questions are continually arising involving demands for new statistical compilation, for human affairs can be properly analysed only with the aid of a well-founded and technically satisfactory statistic. The simplest population-characters are expressible in regard to units, as, for example, the numbers in a population; the wealth possessed, etc. The complex

are those which involve multiple *fields* of comparison, for example, the number of one sex, who, being between given limits of age, and belonging to a given occupation, die of a particular disease.

That the number of comparisons possible is very great is obvious from the fact that n things considered in their mutual instantaneous relations, that is, n things considered each in relation to  $1, \ldots, n-1$  other things, are  $2^n-1$ . The following table will shew the number possible up to n=10.

TABLE X.

No. of in Cor					Elem	ents	of Ori	ginal S	statisti	cal Da	ata.	
1			1	2	3	4	5	6	7	8	9	10
2				1	3	6	10	15	21	28	36	45
3				!	1	4	10	20	35	<b>56</b>	84	120
4						1	5	15	35	70	126	210
5							1	6	21	<b>56</b>	126	252
6								1	7	28	84	210
7				٠.					1	8	36	120
8									• •	1	9	45
9		!									1	10
10	• •	••			• •	•••	• •		••			1
	poss binat eleme	ions	1	3	7	15	31	63	127	255	511	1023

The total possible for 12 is 4095, for 20 is 1,048,575.

There were, for example, 17 main questions to be answered in the Australian Census; thus there would be  $2^{17} - 1$  (viz., 131,071) possible tables by combinations of these results, and a considerable proportion of these would be of real significance.

2. Characters directly given or derivative.—Important characters are not always immediately yielded by the data: they are often to be ascertained only by analysis. Thus, as in the case of statistics generally, population statistics may be either

# A. Direct, viz.:A (i.) Instantaneous (numbers at a given moment). (Examples): No. of persons living; wealth possessed by them at a particular

instant; etc., or

A (ii.) Durational (or number of occurrences during a unit of time). (Examples): Number of persons born, married, or deceased during a day, month, or year; etc.

## B. Derivative, viz.:—

B (i.) Instantaneous (numbers deduced representing a state of things for a given moment or epoch). (Examples): Masculinity at birth, or at a census; wealth possessed, per individual; expectation of life; etc., or

B (ii.) Durational (numbers deduced of occurrences during a unit of time). (Examples): Birth, marriage, or deathrates per day, month, or year; average wealth deduced from probate returns; etc.

The above indication of the nature of population statistic reveals the reason of its extent, which is much greater than is implied in the number of mere combinations of different fields of statistic considered in their instantaneous relations alone.

3. Characters in their instantaneous and progressive relations.—The characters of a population are fully studied only when examined both in their instantaneous relations, and in the progression of these with time. Suppose, for example, that characters A and B both vary with time, and that such variation can be expressed by rational integral functions thereof; then the constant relation of the characters is given by

$$(299)..... \frac{B}{A} \equiv \frac{F_2(t)}{F_1(t)} \equiv \frac{a_2(1+b_2t+c_2t^2+\text{ etc.})}{a_1(1+b_1t+c_1t^2+\text{ etc.})}$$
$$= \frac{a_2}{a_1} \left[ 1 + (b_2-b_1)t - \{b_1(b_2-b_1) - (c_2-c_1)\}t^2 + \text{ etc.} \right]$$

approximately; or including the term in  $t^3$ , and writing

$$(300).....\beta = b_2 - b_1; \quad \gamma = \frac{c_2 - c_1}{b_2 - b_1}; \quad \delta = \frac{d_2 - d_1}{b_2 - b_1}$$

a result of greater precision is given by:-

(301)... 
$$\frac{B}{A} = \frac{a_2}{a_1} \left[ 1 + \beta t \left[ 1 - (b_1 - \gamma) t + \left[ b_1 (b_1 - \gamma) - c_1 + \delta \right] t^2 + \text{etc.} \right] \right]$$

The successive coefficients, in nearly all practical examples, converge with sufficient rapidity to admit of the employment of the formula for even large values of t.<sup>1</sup>

Derived characters involve, as a rule, a greater complexity of change of relation with the lapse of time. Thus, for example, suppose a rate for *persons* is to be deduced from the rates for *males* and *females*, and suppose also that these do not change identically with the lapse of time (as, for example, a death or morbidity-rate for a particular disease). Suppose then that these rates for males and females are respectively:—

$$(302).....m_t = m_0(1 + b_m t + c_m t^2 + \text{ etc.});$$
 and  $(303).....f_t = f_0(1 + b_f t + c_f t^2 + \text{ etc.})$ 

Let us suppose that the ratio of the difference of the sexes to their sum, that is  $(M-F)/(M+F) = \mu$ ; or  $(F-M)/(F+M) = \phi$ ; and that the variation of this function with time is expressed by

(304).....
$$\mu_t = \mu_0(1 + \beta't + \gamma't^2 + \text{etc.}); \text{ and } \phi_t = -\mu_t;$$

then it will follow that the ratio p for persons will be

$$(305)...p = \left(\frac{1}{2} + \frac{\mu}{2}\right)m + \left(\frac{1}{2} - \frac{\mu}{2}\right)f = \frac{1}{2}(m+f) + \frac{1}{2}\mu(m-f)$$

<sup>&</sup>lt;sup>1</sup> Say, ordinarily at least to t = 100.

that is, it will be the mean weighted according to the relative numbers of males and females. The result may at once be written out from (302) and (303), and re-expressed is

$$(306)...p_{t} = \frac{1}{2} \left\{ \left[ m_{0} + f_{0} + \mu_{0}(m_{0} - f_{0}) \right] + \left[ m_{0} \left\{ b_{m}(1 + \mu_{0}) + \mu_{0}\beta' \right\} \right] + \left[ m_{0} \left\{ c_{m}(1 + \mu_{0}) + \mu_{0}(b_{m}\beta' + \gamma') \right\} + f_{0} \left\{ c_{f}(1 - \mu_{0}) - \mu_{0}(b_{f}\beta' + \gamma') \right\} \right] t^{2} + \text{etc.} \right\}$$

From this it is obviously impossible to secure consistency among formulæ for persons, males, and females, where the variation with time of those for the two last is not identical, without complexity of expression. Moreover, when variations with time have to be considered, as well as many fields of comparison, not only do general formulæ become too involved to be of practical value, but also the number of relations necessary to exhaust the statistic becomes hopelessly large. For this reason it is often desirable to compute the coefficients for males, females and persons independently: if this be done with care the involved inconsistency may be regarded as negligible.

4. Conspectus of the population-characters with which the ordinary census is concerned.—In Section 1 of Chapter II. of the general Census Report, a classified statement and a brief review of the objects and uses of a census are given. These present, however, only one aspect of some of the leading characters of population. In the following conspectus a somewhat different and more extensive sketch of such of these characters as are capable of statistical measurement, and which constitute normal bases for comparisons, is furnished:—

## A.—Numerical constitution of population at a given epoch in regard to

- (i.) Sex, and (ii.) age;
- (iii.) birthplace; and (iv.) length of residence in country of enumeration;
- (v.) nationality; and (vi.) race;
- (vii.) conjugal condition; (viii.) duration of marriage; and (ix.) size of family;
- (x.) infirmity;
- (xi.) degree of education; and (xii.) school attendance;
- (xiii.) religion;
- (xiv.) occupation—(a) designation; and (b) grade;
- (xv.) dwellings—(a) material; and (b) number of rooms; (c) mode of occupancy; and (d) rental;
- (xvi.) localisation.

In each case the statistical data initially represent the number of persons possessing the character or group of characters specified, as, for example, the number of persons having a family of a given size, the number of persons having a given duration of marriage.

In the case of dwellings the enumeration is twofold, and comprises, for example, the number of dwellings of a given material, as well as the number of persons living in dwellings of a given material.

# B.—Relative constitution of population in respect of characters enumerated in A.

In this section are comprised the ratios of the numbers possessing a given character or group of characters to the numbers possessing a wider range of such characters, as, for example, the ratio of males under 21 years of age to the total population of all ages and of both sexes.

# C .- Variations of population at different epochs.

This may involve merely variations in aggregate population, or may comprise variations in the numbers possessing any combination of the characters enumerated in A, or in the relative constitutions deduced under B.

# D.-Mean population at a given period.

As in the case of C, this may involve merely the aggregate population or may comprise the mean population possessing any combination of the characters enumerated in A. The mean population for any unit of time represents the number of such units of human life lived by the population or section thereof under observation.

#### E.—Fluctuations of population during a given period.

These arise from :—(i.) Births (see F); (ii.) deaths (see G); (iii.) migration (see H).

# F.—Births.

- (a) The statistical data initially represent the number of births classed according to the following categories, taken either singly or in combination.
  - (i.) Whether live or still birth; (ii.) sex of child;
  - (iii.) whether born in wedlock or not;
  - (iv.) age of father; and (v.) age of mother;
  - (vi.) birthplace of father; and (vii.) birthplace of mother;
  - (viii.) occupation of father;
  - (ix.) duration of parents' marriage (see I.);
  - (x.) locality; and (xi.) date of birth;
  - (xii.) date of registration; and (xiii.) position of child in family, i.e., whether first, second, etc.
  - (xiv.) single or multiple birth.
- (b) The derivative statistical results comprise, inter alia, particulars concerning the relations between
  - (i.) Live and still births; and (ii.) nuptial and ex-nuptial births:
  - (iii.) male and female births;
  - (iv.) number of births and population from which derived,

These may involve merely the relation between total births and total population, or the relation between the number of births possessing any character or group of characters enumerated in  $\dot{\mathbf{F}}$  (a) and the appropriate subdivision of population from which derived. In the one case the result would be the crude birth-rate, or ratio of total births to total population, in the other it would comprise such results as, say, the nuptial birth-rate in a given area amongst fathers of a given age, birthplace, and occupation, who had been married for a given period. Similarly (i.), (ii.) and (iii.) may involve merely totals possessing the characters specified, or may relate to subdivisions possessing any character or group of characters enumerated in  $\mathbf{E}$ : as, for example, the relation between live and still births amongst the nuptial male births of women of a given age and birthplace, who had been married for a given period.

#### G.—Deaths.

- (a) The statistical data initially represent the number of deaths classed according to the following categories, taken either singly or in combination:—
  - (i.) Sex of deceased; (ii.) age; and (iii.) birthplace;
  - (iv.) cause of death, (a) primary, and (b) secondary;
  - (v.) occupation; (vi.) length of residence; and (vii.) locality;
  - (viii.) age at marriage and re-marriage;
  - (ix.) number of issue, according to sex, and whether living or dead;
  - (x.) date of registration.
- (b) The derivative statistical results consist mainly of particulars concerning the relations between the number of deaths possessing any character or group of characters enumerated in G (a) and the appropriate subdivision of population from which derived, such, for example, as the death rate from a specified cause in a given locality amongst males of a given age, birthplace and occupation.
- (c) As derivative results of the second degree may be classed such particulars as
  - (i.) Index of mortality; and (ii.) corrected death-rates;
  - (iii.) expectation of life; and (iv.) detailed mortality tables.

# H.—Migration.

Complete statistical data would initially represent an enumeration of migrants classed according to the characters specified in A, with the exception of (xi.) length of residence; and (xv.) dwellings. Such detail is quite impracticable, and the main characters available in Australia are:—

- (a) For traffic by sea:—
  - (i.) Sex; and (ii.) whether adult or child, or preferably exact age:
  - (iii.) port of embarkation; and (iv.) port of disembarkation;
  - (v.) nationality or race; and (vi.) date of migration,

- (b) For land-traffic by rail:
  - (i.) Sex;
  - (ii.) state in which arrived; and (iii.) from which departed;
  - (iv.) date of migration.
- (c) For land-traffic by road:—

Similar details as in (b).

#### I.—Marriage.

- (a) The statistical data initially represent the number of marriages granted in a given period classed according to the following categories taken either singly or in combination:—
  - (i.) Age of bridegroom; and (ii.) of bride;
  - (iii.) conjugal condition of bridegroom; and (iv.) of bride;
  - (v.) birthplace of bridegroom; and (vi.) of bride;
  - (vii.) occupation of bridegroom; (viii.) locality; and (ix.) date of registration;
  - (x.) by whom celebrated;
  - (xi.) ability of bridegroom to sign register; and (xii.) of bride.
- (b) The principal derivative statistical results are those concerning the relations between the number of persons married during a given period and possessing any character or group of characters enumerated in I(a) and the appropriate subdivision of the population from which derived, such, for example, as the marriage rate amongst bachelors of a given age, birthplace and occupation.

# J.—Divorce.<sup>2</sup>

- (a) Satisfactory statistical data would initially represent the number of divorces granted in a given period classed according to the following categories taken either singly or in combination:—
  - (i.) Age of husband; and (ii.) of wife;
  - (iii.) duration; and (iv.) issue of marriage (a) males; (b) females;
  - (v.) locality; and (vi.) birthplace of husband; and (vii.) of wife;
  - (viii.) occupation of husband;
  - (ix.) sex of petitioner; and (x.) cause of petition;
  - (xi.) date of rule nisi; (xii.) and of making rule absolute;
  - (xiii.) by whom marriage was celebrated.
- (b) The principal statistical results derivative from the foregoing would be relations between the numbers of persons divorced during a given period and possessing any character or group of characters enumerated in J (a), and the appropriate subdivision of the population from which derived, as, for example, the proportion of husbands of a given age, birthplace and occupation, who had been petitioners in granted divorce cases.

<sup>&</sup>lt;sup>1</sup> In Australia this last information is not available.

<sup>&</sup>lt;sup>2</sup> Complete statistics not available in Australia.

#### K.—Sickness and Accident.1

- (a) Satisfactory statistical data initially represent the cases of disablement by sickness or accident occurring in a given period classed according to the following categories taken singly or in combination:—
  - (i.) Sex; (ii.) age; and (iii.) birthplace of person disabled;
  - (iv.) cause of disablement;
  - (v.) occupation; and (vi.) locality;
  - (vii.) date; and (viii.) duration of disablement;
  - (ix.) conjugal condition of person disabled; and (x.) number of issue
  - (xi.) whether or not disablement terminated by death.
- (b) Derivative statistical results would consist mainly of relations between :—
  - (i.) cases and appropriate population;
  - (ii.) cases of deaths.
- (c) Derivative results of a second degree consist of sickness tables constructed from initial data.
- 5. The range of the wider theory of population.—The conspectus just given has obviously been limited to matters with which the census and ordinary vital statistics are more directly concerned. consideration of population, however, the characters of importance include a much larger range, embracing what has already been indicated in § 1, hereinbefore, viz., the anthropometric, anthropological, and sociological, including the economic. This has already been referred to: see I., § 6, iii. and iv., and II., §§ 13-18. Because of this fact, a complete theory of population must take account of (a) the reactions of eugenic facts and arrangements upon the numbers and mode of growth of the population of the entire world and of its constituent peoples, and (b) even of the reactions thereupon of all economic and social conditions, including those arising from mobility. This is seen when one contemplates the part played by modern facilities in transport and communication. Nor are the physical and psychical characters of the population less foreign to a complete theory. For the same reason there are aspects of subjects not directly enumerable as population facts, which have immediate touch therewith; such, for example, as national, municipal and private wealth and their fluctuation, concentration and dispersion; the productivity of such wealth, the economics of national and municipal revenues, expenditures, and administrations; the productivity of private wealth, and, indeed, of wealth of all kinds; the correlations between population-fluctuations and such financial characters as national liabilities; the quantity and velocity of the circulation of currency; the relations between primary and secondary production and population development; the growth of institutions expressive of a deepening recognition of social solidarity in co-operative effort, and in the nationalisation of the greater public services, etc. And finally, it may be said

<sup>&</sup>lt;sup>1</sup> Complete statistics are not available in Australia.

that all facts which throw any light whatever on the possibility of worldproduction of food supplies and the fluctuations of population with abundance or want belong to the wider theory of population, and demand appropriate mathematical investigation.

These wider facts are, of course, beyond the range of the narrow limits of ordinary official statistic, but no comprehensive view of the significance of a study of population is possible, which excludes the study of the reaction of material, psychical, or social conditions upon its growth and fluctuation.

The creation of norms.—The significance of statistical results is fully recognised only by comparisons with the similar results for other populations. Such comparisons are effected in the most general way by the creation of norms for each population-character. The principle which governs the constitution of a norm is that it shall represent the character selected on the widest possible basis. Thus, if statistical data existed for every population in the world, world-norms would be possible for every character statistically recorded. Western civilisation is fairly homogeneous and statistical data are available for many characters. Thus it should be practicable in the near future to create a series of norms for the greater part of the western world. These might be regarded as the normal or usual value of any character in question, with which the same character in any particular population may be compared. It is obvious in order to compare a series of populations the best basis is the average value of any character: furthermore, if a compared character is affected by the deviation of any other from the average the value of the norm and of the deviation therefrom furnish the best basis for necessary corrections.

The essential nature of a norm is perhaps best seen by regarding it as representing the characters of all the populations included, considered as a single population. Thus the deviation of the characters and any particular population about the secular changes therein of this great aggregate gives the most informative presentment of the position of the population in question, that can possibly be had: in short, it makes the scheme of comparison as broad as is possible.

7. Homogeneity as regards populations.—Two communities may be said to be homogeneous with regard to any series of characters, when those characters are identical. In comparisons between communities in regard to any one character, it is necessary, in order that the comparison should be a just one, that all other characters which have any influence thereupon should be identical; or, to put this more generally, the comparisons of any selected characters in a community are legitimate only when these communities are homogeneous with respect to all other characters which may have any influence on the comparison. For example, the birth-rates of two communities are immediately comparable if the relative numbers of married and single at each age are the same, because the birth-rate then (presumably) reveals the fertility under identical physiological conditions.

Since, however, different communities are more or less heterogeneous, appropriate schemes must be developed through which rigorous comparisons can be effected. Thus, for example, corrections may be applied in such a way that any character compared or contrasted will not be affected by difference of other characters.

The most convenient way of securing such a result is to adopt, as a basis for all comparisons, a population so characterised as to represent all others to be compared as nearly as possible. Such a population may be called a "normal" or a "standard" population, and any character in regard to which it has been standardised may be called a "norm."

8. Population norms.—In order that any character of a number of populations or communities may be conveniently compared, it will be necessary that whatever population be adopted as basis, it shall represent each as nearly as possible. It is easy to see that, in regard to any character under review, such a basis must be a weighted mean, so that the character adopted as basic shall be the character of the population formed by aggregating all populations which may have to enter into comparison. Thus if P, Q, R, etc., be populations, and p, q, r, etc., be the values of some one character in each, then the best basis of comparison is :-

$$(307)......\frac{Pp+Qq+Rr+\text{etc.}}{P+Q+R+\text{etc.}} = \frac{Ss}{S} = s$$
S being the sum of  $P+Q+R+\text{etc.}$ , and s the norm.

It is immediately obvious that, in general, the secular changes of norms will be less marked than the secular changes in respect of the same character of the individual populations from which the norm is determined. For this reason it will be necessary for the progress of exact statistic to establish a series of norms for all elements the comparison of which are important. That is, we must adopt a standard or normal population of definite characters, or, in other words, create a series of population norms to serve as a basis for comparisons. The scheme then of com parison is to apply the ascertained attributes of each existing population to the standard population. This process will reveal what would have been manifested had each population been similarly constituted to the standard population.

Variations of norms.—Inasmuch as, in the present development of statistics, norms have not been created, except perhaps as regards the constitution of population of each sex according to age, it will suffice to indicate the outlines of a general method of studying the variation of norms. Since necessarily they can vary only slowly, a decennial determination will be probably always sufficient, and when a number of decennial changes are to hand, the investigation of their variation will become possible. Whether such variation will reveal any sign of periodicity or not it is at present impossible to say. It is not unlikely that periodic elements of variation will be found superimposed upon slow secular changes. This, however, must be left for the future to determine, and the appropriate method of analysis will depend upon the character of the data.

10. Norm representing constitution of population according to age.— A norm for males and one for females of European race is of importance for properly comparing death, marriage, birth and other rates. The use of such a norm was proposed by Dr. Ogle at the meeting of the "Institut International de Statistique," in Vienna, 1891, and the index of mortality at present used is based upon such a norm, though not a properly constituted one. The aggregation of the populations of a considerable group of countries between which also there is migration, removes the specialising influence of this latter element, and secures the general advantages of large numbers. The following results were obtained from combining the populations of England and Wales, Scotland, Ireland, the United States, the German Empire, Norway, Sweden, Italy, Canada, Australia, and Newfoundland generally for the censuses of 1900 or 1901,1 The numbers are given in each age-group, and above a given age :--

TABLE XI.
Population Norms for 1900.

Age.	Numl	pean (19 bers in p in tot 10,000.	Age- al of	Numl	ia ( <b>190</b> bers in p in tot 10,000.	Age- al of	Age.	European (1900). Numbers at and above age indic- cated.			
	Males.	Fe- males.	Per- sons.	Males.	Fe- males.	Per- sons.		Males.	Fe- males.	Per- sons.	
0	270	263	266	266	276	271	0	10,000	10,000	10,000	
1-4	971	953	962	988	1,063	1,025	1	9,730	9,737	9,734	
5-9	1,139	1,119	1.129	1,394	1.382	1.388	5	8,759	8,784	8,772	
10-14	1,057	1,038	1,047	1,264	1,081	1,174	10	7,620	7,665	7,643	
15-19	975	980	977	866	835	851	15	6,563	6,627	6,596	
20-24	915	931	923	787	892	838	20	5,588	5,647	5,619	
25-29	808	813	810	879	894	887	25	4,673	4,716	4,696	
30 - 34	715	705	710	848	851	850	30	3,865	3,903	3,886	
35 - 39	640	624	632	609	557	583	35	3,150	3,198	3,170	
40-44	563	550	557	648	652	650	40	2,510	2,574	2,544	
45–49	470	463	467	370	339	355	45	1,947	2,024	1,98	
50-54	413	417	415	437	452	445	50	1,477	1,561	1,520	
55-59	331	344	337	177	169	173	55	1,064	1,144	1,10	
60 – 64	272	290	281	254	303	278	60	733	800	768	
65 - 69	197	212	205	66	79	72	65	461	510	48'	
70–74	136	150	143	76	91	84	70	264	298	282	
75–79	79	88	84	27	32	29	75	128	148	13	
80 - 84	36	43	39	30	35	33	80	. 49	60	58	
85 - 89	10	13	12	5	6	5	85	13	17	[ 16	
90 - 94	3	3	3		7	6	90	3	4	4	
95-	1	· 1	1	3	4	3	. 95	1	1		
rotal	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	

<sup>&</sup>lt;sup>1</sup> See "The determination and uses of population norms representing the constitution of populations according to age and sex, and also according to age only." By G. H. Knibbs, and C. H. Wickens, Trans. 15th, Int. Congr. Hygiene and Demography, Washington. Vol. VI., pp. 352-378.

11. Mean age of population.—The mean age,  $x_m$  of a population is given by the formula

$$(308)....x_m = \frac{\int_0^{\omega} x l_x dx}{\int_0^{\omega} l_x dx} = \frac{1}{2} + \frac{\sum_0^{\omega} x L_x}{\sum_0^{\omega} L_x}, \text{ approximately.}$$

 $l_x$  denoting the relative frequency at the age x,  $\omega$  the greatest age attained or considered, and  $L_x$  the number of age x last birthday, it being assumed that this number may, on the average, be regarded as of age  $x + \frac{1}{2}$ . Omitting the  $\frac{1}{2}$ , this last expression really gives the correct mean age last The mean age next birthday,  $x_n$ , of a population under the age n is

$$(309).....x_n = \frac{nL_{n-1} + (n-1)L_{n-2} + .... + L_0}{L_{n-1} + L_{n-2} + .... + L_0}$$

From this formula it is evident that, with a table giving the number at and above each integral age, all that is requisite to obtain the mean age next birthday is to divide the total population into the sum of the numbers from the youngest to the oldest ages. Deducting ½ gives the usual approximation to the mean exact age, while a deduction of unity gives the mean age last birthday.

The mean age in years of the normal or standard population is, for 1901:--

> Males.Females.Persons.26.934 years. 27.341, years. 27.148. years.

This mean age is, of course, not what is known actuarially as the expectation of life at age 0, but is the average age of all persons living at a given moment, or, in other words, it is the average past lifetime of the population at a given moment. On the other hand, the expectation of life at age 0 is the average future lifetime of all persons born. case of a stationary population, however, with rates of mortality varying with age, but remaining constant for each age through a great length of time, the average past lifetime of the population at a given moment is equal to its average future lifetime, that is, the average age of the population is equal to the average "expectation of life" of the population as a Thus for the population of Europe in 1901 persons had lived on

$$e_x^{\circ} = \int_x^{\omega} l_x \, dx / l_x = T_x / l_x$$

and consequently the total future lifetime of these  $l_x dx$  persons is

$$e_x^{\circ} l_x dx := l_x dx T_x / l_x = T_x dx$$

 $e_x^\circ \, l_x \, dx \coloneqq l_x \, dx \, T_x \, / \, l_x = T_x \, dx$  Hence the total future lifetime of the whole existing population between 0 and

$$\int_{a}^{\omega} e_{x}^{\circ} l_{x} dx = \int_{a}^{\omega} T_{x} dx$$

 $\int_{a}^{\omega} e_{x}^{\circ} \, l_{x} \, dx = \int_{a}^{\omega} T_{x} \, dx$  and as a whole existing population is  $\int_{a}^{\omega} T_{x} \, dx$ , the average future lifetime or expectatation of life of the whole existing population is  $\int_0^\omega T_x dx / \int_0^\omega l_x dx$ , which may be shewn to be equivalent to  $\int_0^\omega x l_x dx / \int_0^\omega l_x dx$ , or the mean age.

The expectation of life  $e_x^o$  of the  $l_x$  dx persons of the exact age x is the future lifetime T, of these, divided by their number, that is-

the average about 27 years. The expectation of life changes with the lapse of time, and is appreciably lengthening. Thus the secular change of the norm will be the weighted average of the changes of the constituent populations.

12. Population norm as a function of age.—The number of persons, Y, at and above the age x may be closely represented by

$$(310)\ldots Y = k\alpha^{a^x}\beta^{b^x} = 52674(0.99961)^{1.10808^x}(0.18998)^{1.01495}$$

which is a development of the Gompertz-Makeham type of formula. The constants indicated fit very closely the values of the norm given in preceding table. This matter will be dealt with more fully hereinafter.

<sup>&</sup>lt;sup>1</sup> For solution, vide op. cit. pp. 364-7.

# IX.—POPULATION IN THE AGGREGATE, AND ITS DISTRIBUTION ACCORDING TO SEX AND AGE.

1. A Census and its results.—A well-conducted Census furnishes results which are substantially correct so far as the aggregate number of persons and the aggregate number of each sex is concerned. That is, if p, m and f denote the errors of the numbers of persons, males and females respectively, and P, M and F their respective aggregates, then p/P, m/M and f/F are all extremely small quantities, which can have no important bearing upon the general theory, or upon any deductions flowing from it. Unfortunately this is not true regarding the numbers of either sex between given age-limits.

In Chapter X of the Census Report, it has been shewn that for Australia the Census results bear intrinsic evidence of great improvement in regard to accuracy of statement respecting age; see §§ 3 and 5. The nature of this is shewn in the tables given of numbers and percentages for the ages 28, 29 . . . . 32, and 48, 49 . . . . 52. The exces sive statements, for example, for the ages 30 and 50, became markedly less. The results were as follow:—

Census	Age.	1891.	1901.	1911. 1	911(adjusted)	).
Percentage of age-	,		22.00	20.00	10.00	
quinquennium in-	30	23.35	22.98	20.90	19.96	
cluding two years	50	29.06	25.77	21.75	20.16	
on either side						

A glance at Figs. 37 and 38 hereinafter will shew that the curves of numbers according to age for ages 30 and 50 do not depart very much from a straight line. For the former age the curves are concave upward; for the latter, convex upward. Hence at 30 the mean should be somewhat less, and at 50 somewhat more, than 20 per cent. The ratio determined from the smoothed results are shewn in the final column. We shall consider the question of smoothing the results later.

For each it is seen that the numbers for the ages in question were excessive, enormously so for 50 years of age, in the 1891 Census. The error, however, was diminished for the Census of 1911, probably largely in

consequence of a special attempt to ensure the population appreciating the necessity for accuracy.<sup>1</sup> It may be said, however, that statements of age leave much to be desired.

- 2. Causes of misstatement of age.—Many people are so indifferent as regards their age that they are really unaware what it is, and for this reason tend to assign round numbers (viz., ages ending with the figure 0 or the figure 5), as roughly expressing about their ages. In the case of persons approaching 21 years of age, what may be called "matrimonial reasons" exist for an overstatement, and this may continue to operate for a year or two. In the case of females the tendency to overstate the age is, on the whole, negative for a considerable period of life.<sup>2</sup> For the older ages, however, there is probably a distinct tendency in the opposite direction.<sup>3</sup>
- 3. Theory of error of statement of age.—Assuming both a tendency to express in round numbers ending in 0 and 5, an age not accurately known, and also particularly in the case of females some tendency to understate age, except for ages above, say, 60, we ought in general to find the following characters in the crude results of a Census, viz. :—
- (i.) In smoothing the crude results so as to conform to the general trend, the results for ages ending in 0 have to be considerably reduced; while those ending in 5 have to be reduced a somewhat smaller amount.
- (ii.) The amounts of the corrections for ages above and below the round numbers on the whole shew some asymmetry, though at the same time, owing to the masking effect operating in ages so close as x + 0 and x + 5, this character is not definite.
- (iii.) The curves for males and females exhibit systematic differences of form due to systematic misstatement.

Figs. 37 and 38 shew the graphs of the numbers for each year from 0 to 100, for the Australian Commonwealth. It will be seen from these that, for a population profoundly affected by migration, no systematic difference of form actually exists of sufficient magnitude to unmistakably indicate systematic misstatement of age. The marked tendency to give ages ending with the figure 0 is, however, very evident, so also that to give ages ending with the figure 5 is also fairly clear.

<sup>&</sup>lt;sup>1</sup> Where the official administration of a community is sufficiently systematic to require every one to keep a card of identification, it is easy to get correct answers to this and similar questions. The public appreciation of the importance of correct answers is regrettably deficient.

<sup>&</sup>lt;sup>2</sup> For matrimonial and economic reasons, and even reasons not entirely disassociated with personal vanity; the two latter reasons also operate in the case of males, but to an appreciably lesser extent.

<sup>&</sup>lt;sup>3</sup> Certain investigations shew that vanity concerning longevity is not wholly absent in either sex.



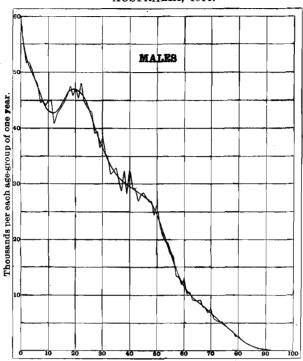


Fig. 37

Commencing points of age-groups of one year at age indicated.

AUSTRALIA, 1911.

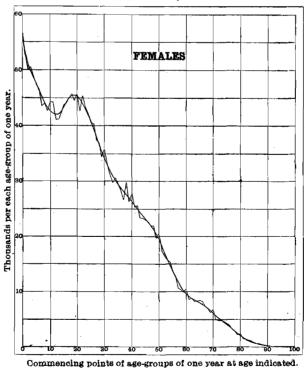


Fig. 38.

The curves in Figs. 37 and 38 are interpreted in the following way, viz.:—The ordinate or vertical distance to the curve at any point represents in thousands the number of males (or females) in the age-group of one year, commencing at the age in question. The zig-zag line denotes the results furnished immediately by the Census, and the curve the smoothed (and more probably correct) results.

4. Characteristics of accidental misstatements, and their fluctuations.—The Censuses of the various States of Australia never having been combined, it was desirable to compile the three preceding Censuses, viz., those for 1881, 1891, 1901, in order to deal thoroughly with that of 1911. The results were not in age-groups for single years for 1881, but were for the later Censuses. In doing this it was found on inspecting the graphs for 1891, 1901 and 1911, of the numbers enumerated for each age, that in the statements of age there were tendencies to concentrate on certain ages, and to avoid certain others. In order to definitely examine these tendencies a tabulation was made of the data in respect of the unit figure in the year of age stated in Australia at the Censuses of 1891, 1901 and 1911. To enable an estimate to be made of the degree of error involved in these statements of age, the smoothed results were similarly tabulated according to the unit figure in the year of age, and the ratio of the former set of results to the latter was obtained for each sex and each unit figure. The results should, of course, be unity if the errors balanced, or had no tendency in any direction.

The ratios so obtained are as follows:-

Table XII.—Ratio of Number Recorded to Adjusted Number, Censuses 1891, 1901, 1911, Australia.

YE	AR.			Unit 1	Figure	IN AG	E LAST	Віктні	AY		
	OF NSUS 0 1 2 3 4 5 6 7 8										9
					M	IALES.				`	
1891		1.1388	.9167		.9545	.9969	1.0366			1.0055	.9532
1901 1911	• •	1.1044 1.0485	.9369 .9956		.9677 .9787	.9809 .9990		1.0134 1.0097	.9636 .9691		.9667 .9695
		-					!	, [	•		
					F'E	EMALE	is.				
1891		1.1251	.9288		.9848		1.0077		.9640		.9558
$1901 \\ 1911$	• •	$1.0926 \\ 1.0367$	.9270 $.9895$	1.0039 $.9935$	$.9861 \\ .9895$		$1.0106 \\ 1.0050$	$1.0128 \\ 1.0066$	.9708 $.9770$	$1.0165 \\ 1.0148$	.9738 $.9760$

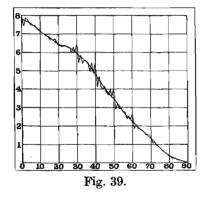
The outstanding indications furnished by this table are for both sexes

- (i.) A marked tendency to concentrate on ages ending in 0.
- (ii.) A less marked but persistent tendency to concentrate on ages ending in 5, 6 and 8.
- (iii.) A marked tendency to avoid ages ending in 1, 3, 7 and 9.
- (iv.) A tendency to state ages ending in 2 and 4 with fair accuracy, concentrations and avoidances being in evidence, but relatively small in respect of these ages.

The table also furnishes an indication of the *increasing accuracy* of statement of age at successive Censuses, the excess at ages ending in 0 having fallen from 13.88 per cent. in 1891, to 4.85 per cent. in 1911, in the case of males, and from 12.51 per cent. in 1891, to 3.67 per cent. in 1911, in the case of females.

Another interesting feature of the results is the evidence furnished that inaccuracy of statement is more marked amongst males than amongst

ENGLAND AND WALES, 1911.



females. Thus, for the Census of 1891 the mean deviation from unity (irrespective of sign) of the above ratios was .0438 for males, as against .0332 for females. The corresponding figures in 1901 were .0358 for males, as against .0281 for females, and in 1911 they were .0181 for males, as against .0143 for females.

Another remarkable feature, worthy of attention, in the population-graphs for Australia, as compared with those of England and Wales, is the similarity of the features for ages 37, 38, 39, and 40, viz., in the graphs for "males" and for "females" of the former, with that

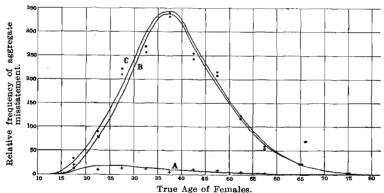
for "persons" for the latter country. There is also some similarity at ages 50 and 60, due to excessive numbers for the ages ending in 0; see Fig. 39.

5. Characteristics of systematic misstatement.—It having been ascertained that in some cases the ages given in the Census cards were not correct, notwithstanding the explicit directions, persons who made misstatements were invited to send in corrections. Out of over 7000 received, 1660, containing definite information as to the age given and the amount of misstatement of age in the case of females, were tabulated in age-groups, and according to the number of years the age had been misstated. Of these, one-half (830) were for the State of Victoria, and the balance of 830 for the State of New South Wales. The tabulated results were as follows:—

Table XIII.—Analysis of 1660 Cases of Misstatements of Age at Census of 1911, Australia.

						Co	RREC'	r Ag	E.					No. P	ER 1000.
CORRECTION I YEARS.	IN ,	Un- der 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 to 55	56 to 60	61 to 70	Ov- er 70	Total.	% Crude.	Smooth- ed,
Over 5 4 22 1		2 1 3 5 4 5	$-\frac{1}{3}$	- 1 2 1 8	1 1 1 4 5	1  1 1 3	$\frac{2}{1}$ $\frac{1}{2}$ $\frac{1}{5}$	1 1 1 1 4	$-\frac{2}{2}$ $\frac{1}{1}$	_ _ _ 1 2			7 4 7 17 14 40	79 45 79 191 157 449	19 64 96 146 226 449
Total Smoothed	::	20 5	10 17	12 18	12 14	6 11	11 8	8	6	3	1 2	1	89 89	1000 =53.6	1000
0 Ver 15		10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	55 21 4 — — — — —	80 62 36 18 5 1 1	56 62 48 26 30 13 7 6 2 6 -	72 87 45 49 23 21 10 7 4 13 2	49 48 37 23 26 20 8 4 16 2	41 54 27 19 23 13 9 8 1	22 17 11 9 11 4 3 5 10 3	9 5 11 9 3 6 1 4 2 3 1 1	$ \begin{array}{c c} 6 \\ 9 \\ 5 \\ 9 \\ 4 \\ 3 \\ 1 \\ - \\ 2 \\ 6 \\ 1 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$	1 - - 3 1 - - - 1	401 372 231 165 126 95 42 37 20 63 14	255 237 147 105 80 60 27 24 13 40 9	255 193+37* 145 107 79 58 41 27 18 11+25*
Total Smoothed	::	13 13	80 77	$\begin{array}{c} 211 \\ 168 \end{array}$	$\frac{257}{284}$	333 337	$\frac{243}{268}$	209 189	$\frac{117}{120}$	55 64	46 44	7	1571 1571	1000 = 946.4	1000
Grand Total Smoothed	::	33 18	90 94	223 186	269 298	339 348		217 195	123 124	58 67	47 46	7 8	1660 1660	=1000	

<sup>\*</sup> The abnormality is about 37 in the one case, and 25 in the other. The 193 and 11 would be the normal values in a total of 1000 — 37 — 25 = 938.



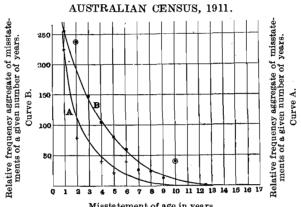
Relative frequency of Overstatements (A) and Understatements (B) of age with females according to true age.

Fig. 40.

In the above table, the results of which are shewn in Figs. 40, 41 and 42, the "smoothed" figures for the aggregate number of overstatements according to age probably very closely represent the tendency in general: the results, however, for under 20 years of age appear to be unduly large. The smoothed results for the aggregate of understatements according to age indicate the probable tendency in general. The smoothed result for the total number of misstatements (over and under) according to age are merely the sum of the preceding. The crosses, squares and circles

represent the age-group aggregates for overstatements, understatements and total misstatements, respectively. These results are shewn respectively by curves A, B and C in Fig. 40.

The smoothed results of the aggregate number of overstatements according to the amount of overstatement (see the vertical column at the right hand side of the table) probably represent the distribution, but the aggregate 89 is so small that it can be regarded only as a rough indication. The graph of this is curve A of Fig. 41.



 $\begin{array}{c} \text{Misstatement of age in years.} \\ \text{Curve $\Lambda$ denotes overstatement; curve $B$ denotes understatement.} \\ \text{Fig. 41.} \end{array}$ 

The smoothed result of the number of understatements according to the amount of understatement, is probably represented by the final column in the table. In this, however, the abnormality of understatements of 2 and 10 years is very striking. The graph is curve B of Fig. 41, and the abnormal position for 2 and 10 year understatements is shewn by the small squares with circles surrounding. This abnormality is probably on the whole real; that is to say, misstatements of 2 and 10 years had a real predominance over the number which might have been expected according to a probable law of frequency based upon misstatements of other amounts (say, a frequency varying inversely as some power of the magnitude of the misstatement). At the same time it is also possible that in part it represents defects in the allegation as the amount of misstatement.

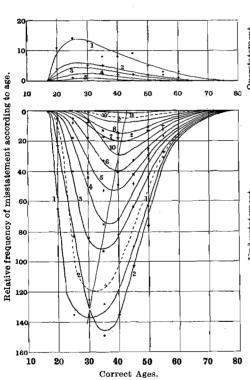
6. Distribution of misstatement according to amount and age of persons.—By forming a series of 10-year groups from Table XIII., with the central ages 20, 25, 30, etc. (completed years), and plotting these as ordinates, some idea is obtained of the form of the function representing the relative frequency of misstatement according to both age and magnitude of misstatement. Curves are then drawn among these positions, the results shewn on Fig. 42 being thus obtained. The families of curves are obviously fairly regular, and are skew. The positions of the ordinate-terminals, obtained as described, are shewn in the following way. The

<sup>&</sup>lt;sup>1</sup> In a Census the frequency is for integral amounts of misstatement only.

character of the mark denoting the terminal of the ordinate for a misstatement of 1 year is a dot; for 2 years a vertical cross; 3, a square; 4, a slanting cross; 5, a circle and vertical line; 6, a lozenge; 7, a circle and horizontal line; and 8, a slanting cross. After the age 55 the results are rather irregular.

The broken lines for understatements of 2 years and 10 years shew what may be regarded as the "normal" positions. That is, had there been no peculiar predominance in the adoption of ages differing by these amounts from the true age, the frequency curve would have been found in about the position of these broken lines. They are numbered with light-faced figures.

The frequency of misstatement according to age, as indicated in Table XIII. and Fig. 42, refers to the number actually existing in the age-groups, for which Table 18 of Part I. of the Australian



The figures on the curves denote the amount of misstatements in years.

Fig. 42.

Census may be consulted (pp. 32-33). To ascertain the frequency for equal numbers of females a correction is necessary, viz., division of each result by the number in the agegroup to which it refers.

Although over 7000 acknowledgments of misstatements of age were received, mostly from women, the proportion these bore to the aggregate number of misstatements was not ascertainable, and after a study of other errors revealed by the zigzag character of the enumerated age-groups, it was decided to regard the characteristic misstatement as sensibly negligible. The absolute scale of the frequency is not known, since the total number of misstatements could not be inferred. Nevertheless its form is important

as throwing light upon the relative frequency of misstatements of different amounts by women of different ages. The result may be summed up as follows:—

The analysis of acknowledged misstatements shewn in the table gives the following indications (of course for females only):—

- (i.) Understatement of age constitutes 94.64 per cent., and overstatement 5.36 per cent. of the aggregate cases of misstatement.
- (ii.) Excepting in the case of understatements of 2 years and 10 years, which are evidently abnormal, the frequency of misstatement diminishes with the number of years misstated, at first very rapidly and later more slowly.
- (iii.) The greatest frequency of understatement of all amounts corresponds to the age of about 37½ years.
- (iv.) The age corresponding to the greatest frequency of understatement of a given number of years increases with the amount of understatement approximately in the ratio of about 1½ years for every year of understatement, except in the case of 2 and 10 years.
- (v.) The frequency of understatements of 2 years is about 1.2 times that which would accord with the general tendency to understatement; and the maximum is for the age of about 35 years.
- (vi.) The frequency of understatement of 10 years is about 3.3 times that which would accord with the general tendency to understatement; and its maximum is for the age of about 30 years.

While these indications, being based upon only 1660 investigated cases, have limited validity, they are probably substantially correct. An insufficient number of returns were received from males to draw any deductions as to the frequency of misstatement according to age and amount of misstatement.

For correction purposes misstatements regarding age are best tabulated according to the age declared; on the other hand, for the expression of the measurement of misstatement they are better tabulated according to the true age. Since probably by far the greater number of persons give their age correctly, it is probably desirable to regard the curves for overstatement and understatement as discontinuous at the value zero.

- 7. The smoothing of enumerated populations in age-groups.—The generalities of smoothing have been partially dealt with in VII., hereinbefore; see particularly §§ 1–9. Figs. 37 and 38 shew the graphs of the enumeration in age-groups of the Australian Census of 1911; obviously these are not the true results. It is obvious that the "smoothed" curve must be of higher accuracy than the zig-zag results, since there are strong reasons for believing that the numbers are sufficiently large to give a "smooth curve." The following principles may be taken as a guide in smoothing:—
  - (i.) Any smoothed curve so drawn as to equalise the zig-zag results (doubtless) better represents the facts than the original data.

- (ii.) The drawing of the smoothed curve can be assisted by arithmetical and algebraic devices.
- (iii.) The adoption of a particular position for the smoothed curve must be governed not only by mathematical considerations, but by the probabilities of each particular case.
- (iv.) If arithmetic or algebraic methods are employed, they should be such as do not involve systematic error.
- (v.) The accumulations of error at all ages should be as small as possible, and therefore should frequently change in sign, and the grand total should be approximately (or exactly) the enumerated total.<sup>1</sup>

The method of smoothing by drawing a curve fulfilling the conditions indicated is known as the *graphic method*. Before considering it further, we shall examine the essential character of smoothing by grouping, and the limitations of smoothing by grouping methods. First, we consider the error introduced by mere means of aggregates.

8. The error of linear grouping.—If a series of points lie on a curve say, convex upwards, their mean, weighted or otherwise, will obviously lie below the curve, that is,  $x'_m$ ,  $y'_m$ , denoting the mean of the co-ordinates, and w the weight assigned to any point, the point having these co-ordinates, viz.:—

$$(311)....x'_{m} = \frac{\Sigma(wx)}{\Sigma w}; \quad y'_{m} = \frac{\Sigma(wy)}{\Sigma w}$$

will, in the case supposed, be below the curve. If the original points lie on a straight line, the point will, of course, be on that line. Graphically, the point may be determined for equal weights thus:—

Let P, Q, R, S, etc., be any points: the point midway between P and Q is the mean of P,Q; the point one-third of the distance of this mean from R, towards R, is the mean of P,Q,R; and, similarly, that one-fourth of the distance of this last toward S, is the mean of P,Q,R,S; and, in general, the mean of n points is 1/nth of the distance of the mean of (n-1) points towards the nth point.

It follows from this that when n values are taken of any quantities, which, being graphed, are found to lie, not upon a straight, but upon a curved line, then the mean of the independent variable (or argument) does not correspond to the mean of the dependent variable (or value of the function) unless the points representing them are all symmetrically situated about the middle point. Thus, if we have the numbers in a population at, say, ages 50 to 55, the mean does not correspond to the age 52. We proceed to consider the magnitude of the systematic error involved.

<sup>&</sup>lt;sup>1</sup> Exact correspondence is neither essential nor extremely desirable, but as it is easy to secure, there is no reason why it should not be insisted upon. A simple way of securing it is to multiply each group-result by a correcting factor, viz., in VII., § 7, herein.

If we suppose the results to be representable by the equation  $y=A+Bx+Cx^2+$  etc., and take points on either side of the middle so that the correct value of y is A, we readily derive the following expressions showing the errors of ternary, quinary, and larger groupings:—

(312).... 
$$\frac{1}{3} \Sigma y = A + \frac{2}{3} Ck^2 + \frac{2}{3} Ek^4 + \text{etc. (ternary)}.$$
  
(313)....  $\frac{1}{5} \Sigma y = A + 2 Ck^2 + 6\frac{4}{5} Ek^4 + \text{etc. (quinary)}.$   
(314)....  $\frac{1}{7} \Sigma y = A + 4 Ck^2 + 28 Ek^4 + \text{etc. (septenary)}$   
(315)....  $\frac{1}{9} \Sigma y = A + 6\frac{2}{3} Ck^2 + 78\frac{2}{3} Ek^4 + \text{etc. (nonary)}.$   
(316)....  $\frac{1}{11} \Sigma y = A + 10 Ck^2 + 178 Ek^4 + \text{etc. (undecenary)}.$ 

If the number of terms in the groups be denoted by n, the law of increase in the numerical coefficients,  $\gamma$  say, of C and  $\epsilon$  of E is as shewn hereunder:—

$$(317).....\gamma C = \frac{1}{12} (n^2 - 1) C.$$

$$(318)..\epsilon E = \left\{ -\frac{1}{30} (n-1) + \frac{1}{30} (n-1)^2 + \frac{1}{20} (n-1)^3 + \frac{1}{80} (n-1)^4 \right\} E$$

The latter may be put in the more concise form in (319) hereunder. Hence the error of a simple mean is shewn in the most general form by the following expression, viz.:—

$$(319)... \frac{1}{n} \Sigma y = A + \frac{1}{12} (n^2 - 1) Ck^2 + \frac{1}{240} \{ (n^2 - 1) (3n^2 - 7) Ek^4 + \text{etc.} \}$$

The values of  $Ck^2$ ,  $Ek^4$ , etc., can be very readily expressed in terms of the ordinates to say the roughly smoothed curve. Thus, using accents to denote ordinates symmetrically situated on either side of the middle (unaccented) ordinate, we have—

(320)...... 
$$\frac{1}{3} (\eta_{,} - 2\eta + \eta') = Ck^2 + Ek^4 + \text{etc.}$$
  
(321)......  $\frac{1}{5} (\eta_{,} + \eta_{,} - 4\eta + \eta' + \eta'') = 2Ck^2 + 6\frac{4}{5} Ek^4 + \text{etc.}$ 

We may therefore from the above equations obtain the value of y, free from the systematic error due to curvature. Thus

$$(322)....y_0 = \frac{1}{3} \{ \Sigma y - (\eta, -2\eta + \eta') \}$$

and from (313) and (321)

(323).....
$$y_0 = \frac{1}{5} \{ \Sigma y - (\eta_{\parallel} + \eta_{\perp} - 4\eta + \eta' + \eta'') \}$$

for ternary and quinary groupings respectively. These correction-terms in the inner brackets are, as a rule, very small.<sup>1</sup>

 $<sup>^1</sup>$  . To reduce the arithmetical work any one number may be taken from each of the values of  $\eta.$ 

The repeated application of any system of grouping leads to more highly smoothed results, but is unobjectionable only if freed from systematic error. It, however, even then, *never* wholly removes the vitiating influence of a value which is seriously defective or excessive.

It is easy to build up from the preceding formulæ a system of coefficients by means of which the repeated groupings can be performed in one operation. Thus, each ordinate being assumed to have equal weight, we have for repetitions of ternary groupings—

No. of Repeti- tions.	Factor.	Resulting Grouping.		Weig	ghts	to l	oe A <sub>l</sub>	oplie	d to	Co-c	ordin	ates.	
0 , .	$\frac{1}{3}$	Ternary					1	1	1				
1	$\frac{1}{9}$	Quinary				1	2	3	2	1			
2	$\frac{1}{27}$	Septenary			1	3	6	7	6	3	1		
3	81	Nonary		1	4	10	16	19	16	10	4	1	٠.
4 .	$\frac{1}{243}$	Undecenary	1	5	15	30	45	51	45	30	15	5	1

Table XIV.—Coefficients for Repeated Grouping.

The scheme of deriving these is evident.<sup>1</sup> In the same way it is necessary to build up also the scheme of corrections from (314), (315), etc.

9. Graphic process of eliminating systematic error.—A simple approximate method of graphically eliminating the systematic error indicated in the preceding section is based on the fact that the distance k between the mean of a series of n ordinates on a parabolic curve and the vertex of the curve is given in Table XV hereunder.

Table XV.—Position of Mean of n Points.

Number (n) of points on curve $\dots n =$	3	4	5	6	7	9	11
Proportional distance of mean of $k = \frac{1}{2}$	$\frac{1}{3}$ h	$\frac{4}{9}h$	$\frac{1}{2} h$	$\frac{8}{15}h$	$\frac{5}{9}h$	$\frac{7}{12}h$	$\frac{3}{5}h$
chord towards vertex of curve $k = $	.33h	.44h	.50h	.53h	.55h	.58h	.60h

the height h being the distance from the middle of the chord to the vertex. Thus, if a series of means of n ordinates are plotted, and a curve be drawn through them, this series can be taken to give an approximate guide to

the shape of the true curve. A section of double the stretch being then taken<sup>1</sup> the interval between the chord and curve along the ordinate is assumed to be four times the similar distance for the central ordinate of the original stretch. Hence in this case the points defined by the means should be moved the following amounts, viz., those in Table XVI.

Table XVI.—Distance of Vertex from Mean of n Points.

Number of ordinates for which a mean is taken	n =	3	4	5	6	7	9	11
Proportion of vertex-dis- tance of the double	$\begin{cases} k = 1 \end{cases}$	$\frac{1}{6}$ H	$rac{5}{36}~H$ .	$\frac{1}{8}$ H	$\frac{7}{60}$ H	$rac{4}{36}$ H	$rac{5}{48}~H$	$rac{1}{10} H$
stretch to be taken as a correction	k =	.167H	.139H	.125H	.117 <i>H</i>	.111 <i>H</i>	.104H	.100H

H denoting the height of the vertex above the chord double stretch. This correction will eliminate the greater part of the systematic error, but not the whole, inasmuch as the curve has been flattened by taking the series of means: hence the corrections having been applied to the mean points a new curve may be drawn, and the process repeated if necessary. A smooth curve is then drawn among the points ultimately defined.

This process, however, yields results which, after all, are but little better than a direct attempt to draw a smooth curve among the points given by the ordinate-terminals; it is tedious, and its probability is but little greater than that obtained by directly drawing the smoothed curve and correcting it by arithmetical (or algebraic) methods ("hand polishing"). To avoid its tedium of drawing and hand-polishing, what are called *summation methods* have been used. In these a weighted mean is obtained, the weight factors having *opposite* signs in order to eliminate the systematic error indicated in formulæ (312) to (316).

10. Summation methods.—Summation methods in so far as they are rigorous, eliminate the systematic error involved in weighted means where the weights have no change of sign. Rigorously devised algorithms, applied to a series of ordinates strictly conforming to a curve of the *n*th degree, will reconstitute the given ordinates, whereas mere means of a series of ordinates will not only *not* do so, but will increase the error with every repetition of the grouping. The taking of the means of a series of ordinates is therefore valid only where the general trend is either linear, or so nearly linear as to make the corrections referred to negligible. Suppose, then, we have a series of ordinates, the terminals of which O, P, Q, R . . . . Z, are to be smoothed. Evidently we can draw an

<sup>&</sup>lt;sup>1</sup> That is, if n+1 be the number of ordinates, a curve defined by 2 n+1 ordinates is taken; thus, if 3 points are originally taken, the curve of double stretch will be that defined by five points.

integral curve of the *n*th degree through any n+1 such points. Geometrically, the summation smoothing process is the following:—Draw a curve of the *n*th degree through the points  $0, 0+i; 0+2i; \dots 0+ni$ : a similar curve through the points  $1, \dots, 1+ni$ : a third through the points  $1, \dots, 1+ni$ : a third through the points  $1, \dots, 1+ni$ : and so on.

This will give a series of curves of the *n*th degree, usually close to one another, and sometimes intersecting. The mean position of their intersections on the ordinates (or ordinates produced) is the smoothed curve required. The flexibility, or *fitting power*, of the curve depends, other things being equal (a) on the degree of the curve; and (b) on the nearness of the points O, O+i, etc.; and consequently of P, P+i, etc., to each other.

It may readily be demonstrated, graphically or otherwise, that as the value of i is increased, minor fluctuations are more and more obliterated. The whole range being limited, the larger the value of n the more points on the curve are fitted by one stretch: hence the smaller i will be; and the fitting power will consequently be increased.

Since the mean position of the intersection of the curves and the ordinates defines the position of their terminals at the smoothed curve; and since each point O, P, etc., is the start of one of the component curves, any abnormality in its position (i.e., deviation from the general trend) is reflected in the mean result; that is, it produces a deviation of a smaller amount in the direction of the abnormal point.

The defect of all summation methods is seen, from their geometrical representation, to be the following:—

- (i.) The degree of obliteration of minor fluctuations is quite arbitrary and depends upon the character of the summation-system.
- (ii.) The result is vitiated by all abnormalities: the method, in fact, does not lead to real smoothing, but to the reduction of the magnitude of the oscillations of the curve.

This may be shewn analytically in the following way. We observe first that if there are q+1 points in the total range of q intervals of any component curve taken, then in a  $complete^2$  series there will be q+1 intersection-points on the ordinates. The mean of these is to be taken. The first complete term arranged according to the powers of the common distance (k) between the ordinates, and the second term will be respectively:—

$$(324).....y_{q} = \frac{1}{q+1} \left\{ (a_{q} + a_{q-1} + ... a_{0}) + (b_{q-1} + 2b_{q-2} + 3b_{q-3} + ...)k + (c_{q-2} + 2^{2}c_{q-3} + 3^{2}c_{q-4} + ...)k^{2} + (d_{q-3} + 2^{3}d_{q-4} + 3^{3}d_{q-5} + ...)k^{3} + ... \right\}$$

<sup>&</sup>lt;sup>1</sup> Where k is the common interval on the axis of abscisse between ordinates, the common interval i between the points will always be an integral multiple of k greater than 1; that is i=2k, or 3k, or 4k, etc.

 $<sup>^2</sup>$  It is, of course, not essential that the series should be what has been called here complete, and in Woolhouse's method it was not complete. A complete series may be defined as one where, q+1 being the number of points including the terminal ones ranged over by any curve, the initial point of the (q+1)th curve is on the same ordinate as the final point of the initial range, viz., the zero (or first) curve.

$$(325).....y_{q+1} = \frac{1}{q+1} \left\{ (a_{q+1} + ...a_0) + (b_q + ...)k + (c_{q-1} + ....)k^2 + (d_{q-2} + ....)k^3 + .... \right\}$$

Thus the coefficients of the powers of x are changing every term, and consequently the equation of the smoothed curve of, say, s+1 points will be of the degree s, that is, it has no relationship whatever to the degree of the originating equations of the nth degree passed through the points 0; 0+i; 0+2i, etc.

It is thus seen that results of a "smoothing" by "summation" methods are in principle *toto cœlo* different from those obtained by methods which ensure conformity to some function adopted for considerations of the nature of the case.<sup>1</sup>

Numerous papers on the summation method have appeared from time to time in the Journal of the Institute of Actuaries by various investigators, of whom the principal are the following:—J. A. Higham, W. S. B. Woolhouse, G. F. Hardy, J. Spencer, T. G. Ackland, G. J. Lidstone, G. King, R. Todhunter. Some of these have contributed several papers on the subject. A specially valuable one, on "The rationale of formula for graduation by summation," by G. J. Lidstone, appeared in the Journal of the Institute of Actuaries, Vol. XLI., pp. 348 et seq., and XLII., pp. 106 et seq. An important paper on the subject by Dr. J. Karup will also be found in the Transactions of the Second Actuarial Congress, p. 31 et seq.

The subject of graduation of summation has also quite recently been re-examined by Mr. C. H. Wickens, and formulæ based on ranges of three determined points (0, 0+i, and 0+2i) and four determined points (i.e., including also 0+3i) are discussed for the developments of quinary formulæ and formulæ other than quinary, the adjective denoting the number of spaces into which i is divided. That is, if i=rk then the formula derived is an r-ary formula. It is shewn that there are great advantages in making the series complete, and that in taking the mean it is advantageous to allow only half-weight to the terminal points of intersection on any ordinate.

The following weights (Table XVII.) have been deduced by Mr. Wickens for the different ordinates about the middle ordinates, th

<sup>&</sup>lt;sup>1</sup> Prof. Karl Pearson's scheme, adopted by many biometricians, is to resolve the data under a suitable type-form derived from a generalised theory of probability, certain criteria being used to decide which form should be preferred. A single Pearsonian curve, however, will not apply to population-enumerations, although the population-curve may be *empirically* considered to be a combination either of Pearsonian or of other curves.

<sup>&</sup>lt;sup>2</sup> An extension of the principle underlying Woolhouse's method of graduation, read 30th October, 1911, Trans. Act. Soc., N.S.W., Session 1912, pp. 243-7.

<sup>&</sup>lt;sup>3</sup> There are many physical analogies for this process. For example, if a physical property be measured at equidistant points along a line including the terminals the mean value is  $(a + 2b + 2c + \ldots + 2y + z)/2N$ , where N is the number of spaces into which the points divide the line.

marked (3) and (4) being deduced from curves passed through 3 points and 4 points respectively. The similarity is obvious. Other formulæ may be obtained from the paper in question.

Table XVII.—Summation-formula-coefficients to be applied to a Series of r Ordinates Deduced on the Basis of (3), and on a Basis of (4) Determined Points.

		$\begin{array}{l} \mathbf{nary} \\ = 2k \end{array}$		$\begin{array}{l} { m rnary} \ = 3k \end{array}$	Quar i:	ternary =4k		=5k	$\begin{array}{c} \text{Senary} \\ i = 6k \end{array}$												
(x/k)	(3)	(4)	(3)	(4)	(3)	(4)	(3)	(4)	(3)	(4)											
- 12 - 11 - 10 - 9 - 8 - 7 - 6 - 5 - 4 - 3 - 2 - 1 0 1 2 3 4 5 6 7 8 9 10 11 12						$\begin{array}{c} \cdots \\ \cdots \\ \cdots \\ -2\frac{1}{2} \\ -4 \\ -3\frac{1}{2} \\ -3\frac{1}{2} \\ 36 \\ 52\frac{1}{2} \\ 36 \\ 17\frac{1}{2} \\ 36 \\ 17\frac{1}{2} \\ -3\frac{1}{2} \\ -4 \\ -2\frac{1}{2} \\ 0 \\ \cdots \\ \cdots \\ \cdots \\ \end{array}$	 -2 -3 -3 -2 0 12 23 33 42 50 42 33 23 -2 -3 -3 -2 -3 -2 -3 -3 -2 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3	$\begin{array}{c} \cdot \cdot \cdot \\ -12^{\frac{1}{2}} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \\ -23^{\frac{1}{2}} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \\ -23^{\frac{1}{2}} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \\ -23^{\frac{1}{2}} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \\ -23^{\frac{1}{2}} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \\ -23^{\frac{1}{2}} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \\ -23^{\frac{1}{2}} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \\ -23^{\frac{1}{2}} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \\ -23^{\frac{1}{2}} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \\ -23^{\frac{1}{2}} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac$	$ \begin{vmatrix} 0 \\ -5 \\ -8 \\ -9 \\ -8 \\ -5 \\ 0 \\ 29 \\ 56 \\ 81 \\ 104 \\ 125 \\ 104 \\ 81 \\ 56 \\ 29 \\ 0 \\ -5 \\ -8 \\ -9 \\ -8 \\ -5 \\ 0 \end{vmatrix} $	$\begin{array}{c} 0 \\ -36\frac{1}{6} \\ -7\frac{1}{6} \\ -9\frac{8}{6} \\ -6\frac{1}{9} \\ -6\frac{1}{9} \\ -6\frac{1}{9} \\ -6\frac{1}{9} \\ -6\frac{1}{9} \\ -6\frac{1}{9} \\ -6\frac{1}{9} \\ -6\frac{1}{9} \\ -6\frac{1}{9} \\ -8\frac{1}{9} \\ -8\frac{1}{9} \\ -7\frac{1}{9} \\ -8\frac{1}{9} \\ -9\frac{1}{9} \\ -3\frac{1}{9} \\ -9\frac{1}{9}	Sum of Co- efficients	32	32	54	54	256	256	250	250	864	864

For the mode of obtaining the values given by these formulæ by processes of *summation*, reference should be made to the paper, in which also the smoothing coefficient is given as follows:—

Table XVIII.—Smoothing Coefficients.

Interval s	No. of Terms or Ordinates $4s-1$	Series (3) $\sqrt{(7s^2+1)/4s^3}$	Series (4) $\sqrt{7(s^2-1)(s^2+5)+36s/6s^4}$
2	7	.1683	.1683
3	11	.0741	.0615
4 5	. 15	.0415	.0316
5	19	.0265	.0193
6	23	.0184	.0130
7	27	.0135	.0094
8	31	.0103	.0071
9	35	.0082	.0056
10	39	.0066	.0045

The smallness of the smoothing coefficient is a measure of the efficiency in smoothing. $^1$ 

11. Advantages of graphic smoothing over summation and other methods. This graphing of the group-results of an enumeration (numbers according to years of age in the instance immediately under review) yields a succession of rectangles, or, if we prefer, points denoting their heights. Smoothing in such a case consists essentially in transferring numbers of those who alleged they were a given age to some other nearly identical age, the reason for this transfer being that it is judged a priori (and justly so) that the irregular distribution indicated by the data does not accord with the real facts. To do this there is no better way than to draw among the tops of the rectangles (or the points representing them) a smoothed curve following every variation of their general trend, which, in the judgment of the analyst,2 is regarded as probably conforming to the This can be done, and the result scaled and smoothed arithmetically, that is, by differencing. The aggregates as by enumeration and by the smoothed curve can be formed, and the accumulated differences examined to see that they are kept within probable limits; that is, are alternately positive and negative, and are never great (see VII., §12). The initial curve can then be amended whenever improvement seems possible; thus in its final form the grand total can be made identical with the enumeration, and the difference between the enumerated and smoothed aggregates up to any value of the variable (age) can be made the least possible for the form of curve deemed to be best on examining the graph of the enumerated results.3

The logic of this process has been admirably expressed by Whewell, and before him again by Sir John Herschel, in the following passages:—

"This curve once drawn must represent . . . . the law . . . much better than the individual raw observations can possibly . . . . do . . . . The series of lines joining the consecutive points . . . cannot possibly represent reality . . . . . If, however, we thus take the whole mass of the facts . . . . by making the curve which expresses the supposed observations regular and smooth . . . we are put in possession . . . of something more true than any (one) fact by itself."—Sir J. Herschel, Trans. Astr. Soc., Vol. V., pp. 1-4.

<sup>&</sup>lt;sup>1</sup> See G. F. Hardy, Journ. Inst. Act., Vol. xxxii., p. 376.

<sup>&</sup>lt;sup>2</sup> Any attempt to dispense with the element of judgment is really illusive. The adoption, for example, of a summation method will yield appreciably different results according to the range taken. Thus a real undulation in a population curve may be virtually obliterated by the process.

<sup>&</sup>lt;sup>3</sup> There is a tendency to forget that technical processes are but instruments in the hands of the user, and formulæ employed confer no validity to the elements depending upon judgment.

"The peculiar efficacy of the Method of Curves depends upon this . . . . that order and regularity are more clearly recognised when thus exhibited to the eye as a picture (and) not only enables us to obtain laws of Nature from good observations, but . . . from observations which are very imperfect. . . . We draw our main regular curve not through the points given by . . . . observations, but among them."—Whewell, Novum Organon Renovatum, Bk. III., Chap. vii., p. 204, 3rd Edit., 1858.

Finally, it may be remarked that by adopting the graphic method of smoothing, minor and unmeaning fluctuations are avoided. The invalidity of merely mechanically applying various summation formulæ has been shewn by G. J. Lidstone; he has indicated how, by the summation method, unmeaning fluctuations are introduced into what may be known a priori to be a straight line.<sup>2</sup>

12. Graphs of Australian population distributed according to age and sex for various Censuses.—Adopting the principles indicated, the graphs of the enumerated population of Australia for the Census of 1911 distributed according to age, shewed that, both for females and for males, the adoption of any function to which the results should be conformed was out of the question. It was evident also that a "summation method" was quite unsuitable. In the results for 1911 there was a sharp increase in the numbers for ages 13 to 18; then a zig-zag result up to age 22 before a decided decrease appeared. It was thus evident that results must be examined, and the smoothing based upon considerations as to the possibility of misstatement. The data therefore were simply graphically smoothed by drawing first a freehand curve among them, the changes of direction of this curve being made a minimum, so far as that was possible, while following all fluctuations deemed to represent the actual facts. This curve was then carefully drawn with the aid of splines, French curves, etc., the ordinates scaled off and adjusted arithmetically.3 The result of this smoothing is shewn on Figs. 37 and 38

As has been shewn in § 10 and formulæ (324) and (325) hereinbefore, this is obvious from either geometrical or analytical considerations. For that reason the graphic process has been preferred to summation processes, which latter are regarded as theoretically invalid for the reasons indicated.<sup>4</sup>

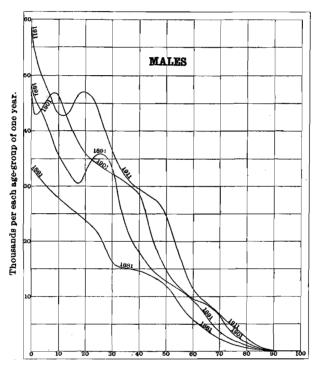
<sup>&</sup>lt;sup>1</sup> See also T. B. Sprague, Journ. Inst. Act., Vol. XXX., pp. 161-3, 1892; James Sorley, Journ. Inst. Act., Vol. XXII., pp. 309-340, in particular 3: The Graphical Method, pp. 321-8; T. B. Sprague's works on "The Graphic Method, etc.," Journ. Inst. Act., Vol. XLI., p. 182.

<sup>&</sup>lt;sup>2</sup> On the rationale of the Formulæ for graduation by summation. Journ Inst. Act., Vol. XLI., 1907, p. 360, and diagrams A, B and C.

<sup>&</sup>lt;sup>3</sup> Identical methods were also applied to the data of the earlier Censuses.

<sup>&</sup>lt;sup>4</sup> In the summation methods, as we have seen, fluctuations are introduced into curves in order to conform to a convenient algorithm, rationally deduced. But a little reflection will convince any mathematician that the minute oscillations in the directions of the tangents, involved in the process, would be better eliminated, when that can conveniently be done; and in any case, in the presence of large departures of individual results from the smoothed curve, these small fluctuations have neither real significance nor validity.

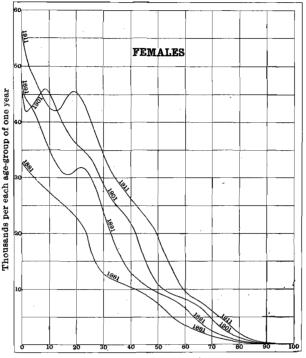
Graphs shewing the distribution according to sex and age have been prepared for the Australian Census of 1881, that of 1891 and 1901, as well as that of 1911. The results for 1881 were deduced from quinquennial groups; those for the latter Censuses from year-groups; and they are shewn on Figs. 43 and 44. It will be seen that intervals of ten years cause considerable differences in the forms of the curves; these differences are due of course to migration and to fluctuations in the birth and mortality rates.



Commencing points of age-groups of one year at age indicated.

Fig. 43.

The curves in Figs. 43 and 44 are interpreted in the following way, viz.:—The ordinate or vertical distance to the curve at any point represents in thousands the number of males (or females) in the age-group of one year commencing at the age in question.



Commencing points of age-groups of one year at age indicated. Fig. 44.

13. Growth of population when rate is identical for all ages. A population  $P_0$  increasing at the instantaneous rate  $\rho$  per unit of time becomes, if that rate be constant, as we have seen,  $P_t{=}P_0\ e^{\rho t}$  see II., §§ 1–10, formulæ (1) to (14). Hence, if the numbers between the ages x and  $x{+}dx$  for the epoch t=0, are represented by  $P_0f(x)dx$ , in which case

$$(326)...\int_{0}^{\omega} f(x) dx = 1$$

and the rate of increase be the same for all ages, then the numbers between the ages x and x + dx at any later date t, must be

 $(327).....P_t dx = P_0 e^{\rho t} f(x) dx$ . the aggregate being  $P_0 e^{\rho t}$ ; that is to say f(x) remains constant. Hence, if the age-groups be divided by the total population, the results will be identical, i.e., the relative numbers will be seen to remain the same and their graphs will be identical. If, however, the aggregate numbers, denoted by F(x), are graphed, the graphs will not be identical. For we have in the latter case

$$(328)....F_t(x) dx = e^{\rho t} F_0(x) dx;$$

and by hypothesis  $\rho$  is not a function of x; hence

$$(329).....\frac{dF_t(x)}{dx} = e^{\rho t} \cdot \frac{dF_0(x)}{dx}; \text{ or tan } \theta_t = e^{\rho t} \text{ tan } \theta_0$$

that is, the *slopes* of the tangents to the graph of the population are increased in the proportion  $I:e^{\rho t}$ . In the absence of all information of "migration" and "natural increase" (increase by excess of births over deaths) the rate of increase of the preceding period must be assumed to continue not only for the population as a whole, but also for each age; which is expressed by

$$(330)....P_t = P_0 e^{\rho t} \int_{x_1}^{x_2} f(x) dx.$$

and (327) hereinbefore.

14. Growth of population where migration element is known. If the ages and numbers of migrants be known, as well as the ages and numbers of the dying, then it is possible to determine the numbers in each age-group by remembering that survivors after t years have increased their age by t years.

Except for very small communities, this method of estimating populations according to age (and sex), is, however, perhaps impracticable. We shall, however, later consider it. Here it may be noted that the estimation may be most conveniently treated in single year age-groups, i.e., not by infinitesimal methods. The value of the method is that it would enable all rates to be finally made up intercensally, whereas, after a Census has rendered the intercensal adjustments possible, they have always to be corrected.

15. Growth of population when rate of increase varies from age to age. Changes in the birth-rate (= rate of immigration at age 0), in the death-rate for various ages (= rate of emigration at age x), in the rapidity of migration and age of migrants (= rate of immigration or of emigration at age x) causes a change to take place in the form both of f(x) and F(x) referred to in the previous section. The graphs of f(x), i.e., of relative numbers, at different epochs all give an area of unity between the limits 0 and  $\omega$  (= end of the longest life); hence the curves for different epochs necessarily intersect; those of F(x), i.e., of absolute numbers, give the areas  $P_t$ , and may or may not intersect. We consider the consequence of those variations which change the form of f(x); see Figs. 43 and 44.

Where we have to interpolate to obtain intercensal populations, or to extrapolate to predict a population, we may assume that the tangents to the curve  $f_0(x)$  change uniformly with time; that is, they become those of  $f_T(x)$  by a linear change with time, T denoting the intercensal period. Thus

(331).. 
$$\frac{df_t(x)}{dx} = \frac{df_0(x)}{dx} + \sigma \frac{t}{T}$$
; where  $\sigma = \frac{df_T(x)}{dx} - \frac{df_0(x)}{dx}$ 

that is,  $\sigma$  is the total change in the tangent in the intercensal period T. Hence, given the total population at the time t, we can effect its distribution according to age by determining merely  $f_t(x)$  on the supposition indicated.

This supposition (i) is of a more general character than that of supposing that the number at any age changes linearly: supposition (ii.). Graphically, the difference between the two is that, according to supposition (i.), the intercept on any ordinate between the graphs of  $f_0(x)$  and  $f_T(x)$ , divided in the ratio t/T, gives the position of  $f_t(x)$ , while according to supposition (ii.) it is the intercept between  $F_0(x)$  and  $F_T(x)$  which is uniformly divided. The advantage of supposition (i.) is that only the form of  $f_t(x)$  is fixed; the graph of  $F_t(x)$  can then be made to agree with any intercensal estimate of population.

16. The prediction of future population and its distribution.—The graphs of population of various countries for the years 1790 to 1910, Fig. 3 hereinbefore, discloses no general law. All shew what may be called oscillatory development. The graph of the population of Australia from 1788 to 1914 (see Official Year Book No. 8 of the Commonwealth of Australia, p. 127) shews also this feature in a fairly well marked degree, and those of the individual States exhibit more striking oscillations. Hence accurate predictions even of total population of any precision are not possible. Figs. 43 and 44 shew that accurate predictions for age-groups are not only not possible, but may be even more misleading than the assumption of an unchanged distribution according to sex and age. It may be noted, however, that there is a general similarity, though there is by no means identity, in the forms of the graphs for males and females. The great fluctuation in the masculinity of the population according to age is also evident from a comparison of the results shewn on Figs. 43 and 44. This, however, will be discussed later.

<sup>&</sup>lt;sup>1</sup> See Census Report, Vol. I., Chap. IX., post-censal adjustment of population estimates for the intercensal period 1901-11.

# X.—THE MASCULINITY OF POPULATION.

1. **General.**—The ratio between males and females in any population has been called its *masculinity*, and the fluctuations of such a ratio are obviously important. The following ratios of the aggregate number of males to the aggregate number of females in various populations will give an idea of how closely the number approximates to unity.

Table XIX.—Masculinity of Various Populations (about Year 1900).

Sweden Scotland Eng. & Wales	$1895 \\ 1901 \\ 1901$	.944 $.946$ $.954$	Italy United States Canada	$1900 \\ 1901$	0.990 $0.044$ $0.050$		1904	$1.024 \\ 1.038$
Germany						Coylon	-00-	

The results given hereinbefore, viz., in VIII., § 9, Table XI., shew that even when the total numbers for all ages for males is made equal to that for females, there are easily discerned differences between Eastern and Western populations.

In the following Table, viz., XX., the aggregate number of males in the different age-groups in the first eleven countries are divided by the aggregate number of females in the same age-groups, the results being shewn on line W; for the last three countries the similar quotients are shewn on line E.

Table XX.—Change of Masculinity with Age; Aggregate of Various Populations, about 1900.

Countri	98.	0	1-4	5-9	10-14	15–19	20-24	25-29	30-34	35–39	40-44	45–49
$_{\mathbf{E}}^{\mathbf{W}}$		1.024 1.003									1.020 1.035	$1.012 \\ 1.131$
Countri	es.	50-54	55–59	60-64	65-69	70-74	75–79	80-84	85–89	90-34	95–100	All Ages.
W E	••	.988 1.005	0.962 $0.095$						.784 .905			.9964 1.0390

The figures in the table shew the relatively large range of "masculinity" for different age-groups, and indicate the desirableness of the determination of a norm for purposes of comparison. We proceed to consider this aspect of the question.

2. Norms of masculinity and femininity.—The variations with the lapse of time, of the norm of distribution according to age for the male population of any community, and the same norm for the female population of the same community will not, in general, be identical. The progressive changes, which may have both periodic and aperiodic elements, are best studied by observing the fluctuation of the masculinity or of the femininity of the population. These characters as ordinarily defined are the number of males to one female (or in practice usually to 100 females), and the number of females to one male, respectively. Thus if m = the number of males, f the number of females, and p = m + f the number of persons of any age, the masculinity  $\mu_1$  and femininity  $\phi_1$  for that age will be expressed by the formulæ:—

$$(332)\ldots \mu_1 = \frac{m}{f}; \ \phi_1 = \frac{f}{m}$$

with suffixes to denote the age. When these quantities and their variations are known, the changes taking place in the relative numbers of the sexes are determined as soon as the variations in the norm for the entire population (persons) are ascertained; see VIII., §§ 8 to 10. The curve shewing the variations of the norms for both sexes at each age from epoch to epoch is not an essential, for their fluctuation is determinable from the fluctuation of the norm for persons, and the fluctuation of either the masculinity or the femininity. For this purpose a somewhat different definition of masculinity is desirable; this we shall now consider.

3. Various definitions of masculinity and femininity.—For many purposes definitions other than that mentioned above have advantages. Both of the functions referred to for ordinary populations approximate to unity. But other functions may be adopted which hover either about  $\frac{1}{2}$  or about zero. For example, the ratio of males (or of females) to the whole population, is a quantity which ordinarily approximates to  $\frac{1}{2}$ ; or yet again the ratio of the difference of the number of males and females to the total population is a number which ordinarily approximates to zero. Algebraically, the three methods and their interrelations are as follows:—

(333)...Masculinity 
$$= \mu_1 = \frac{m}{f}$$
; Femininity  $\phi_1 = \frac{f}{m} = \frac{1}{\mu_1}$   
Possible range 0 to  $+\infty$ ; ordinary value about 1.

$$2nd \; Method := \ (334) \dots \text{Masculinity} \; = \mu_2 = \frac{m}{m+f} = \frac{\frac{m}{f}}{\frac{m}{f}+1} = \frac{\mu_1}{1+\mu_1} \; ;$$
 Femininity  $= \phi_2 = \frac{f}{m+f} = \frac{\phi_1}{1+\phi_1} = \frac{1}{1+\mu_1}$ 

Possible range 0 to +1; ordinary value about  $\frac{1}{2}$ .

$$\begin{array}{l} 3rd \;\; \textit{Method} := \\ (335) \ldots \text{Masculinity} = \mu_3 \; = \frac{m-f}{m+f} = \frac{\frac{m}{f}-1}{\frac{m}{f}+1} = \frac{\mu_1-1}{\mu_1+1}; \\ \\ \text{Femininity} = \phi_3 \; = \frac{f-m}{f+m} = \frac{\frac{f}{m}-1}{\frac{f}{m}+1} = \frac{\phi_1-1}{\phi_1+1}; \end{array}$$

Possible range -1 to +1; ordinary value about zero.

The mutual relations subsisting among these several quantities are set out in the following table :—  $\,$ 

Table XXI.—Relations subsisting between Masculinity and Femininity according to Various Definitions.

Func-		Expressed in terms of—												
tion.	$\mu_1$	$\mu_2$	$\mu_3$	$\phi_1$	$\phi_2$	$\phi_3$								
$\mu_1$	$\mu_1$	$\frac{\mu_2}{1-\mu_2}$	$\frac{1+\mu_3}{1-\mu_3}$	$rac{1}{\phi_1}$	$\left \frac{1}{\phi_2}-1\right $	$rac{1-\phi_3}{1+\phi_3}$								
$\mu_2$	$rac{\mu_1}{1+\mu_1}$	$\mu_2$	$\frac{1}{2}(1+\mu_3)$	$1 \over 1 + \phi_1$	$1-\phi_2$	$\frac{1}{2}\left(1-\phi_3\right)$								
$\mu_3$	$\frac{\mu_1-1}{\mu_1+1}$	$egin{array}{c} \mu_2 \ 2\mu_2 \ -1 \end{array}$	$\mu_3$	$rac{1-\phi_1}{1+\phi_1}$	$1-2\phi_2$	$-\phi_3$								
$\phi_1$	$\frac{1}{\mu_1}$	$\frac{1}{\mu_2}-1$	$\frac{1-\mu_3}{1+\mu_3}$	$\phi_1$	$rac{\phi_2}{1-\phi_2}$	$\frac{1+\phi_3}{1-\phi_3}$								
$\phi_2$	$\left rac{1}{1+\mu_1} ight $	$1-\mu_2$	$\frac{1}{2}\left(1-\mu_3\right)$	$rac{\phi_1}{1+\phi_1}$	$\phi_2$	$\left  \frac{1}{2} \left( 1 + \phi_3 \right) \right $								
φ <sub>3</sub>	$\left \frac{1-\mu_1}{1+\mu_1}\right $	$1-2\mu_2$	- μ <sub>3</sub>	$\frac{\phi_1-1}{\phi_1+1}$	$2\phi_2-1$	$\phi_3$								

4. Use of norms for persons and masculinity only.—Instead of having three norms, viz., one each for males, females and persons, it will often suffice to have one for persons, and one for masculinity. Thus in the norm of population the masculinity, by method 3, viz. (m-f)/(m+f) is as follows for Europe (i.) and for India (ii.).

Table XXII .-- Change of Masculinity with Age.

AGE GROUP,	0	to 4	to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	4 to
(i.) (ii.)	.013 .018	.009 .037	.008 + .004	.009 + .078		.009	.008	.007 .002	+ .013 + .045	.012 .003	0.
AGE GROUP.	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89	90 to 94	9 t
(i.) (ii.)	+ .008 + .044	.005	.019 + .023	.032	.037	.049	.054 .085	.089	.130	.000	.0

5. Relation between masculinity at birth and general masculinity of population.—It has been suggested that some tendency exists which, while not very strongly expressing itself, is nevertheless sufficiently evident to equate the numbers of the sexes in the population of any country, or at least that the masculinity at birth is in some way affected by the masculinity of the population. Masculinity here denotes merely the ratio of males to females, that is, M/F.

The population of Australia has enormously changed in its masculinity in a few decades, and consequently affords an opportunity of examining this supposition. The masculinity at birth is compared with that of the population for the years 1829–1913, the latter passing through a wide range of falling values. The results are shewn in the following table:—

Table XXIII.—Average Masculinity of Population and of Births, New South Wales, over Various Periods.

		Average Masculinity				Average	Masculinity		
Period,		for Years.	of Popu- lation.	of Live Births.	Period.	for Years.	of Popu- lation.	of Live Births	
1829-34		6	2.961	1.016	1840-49	10	1.625	1.03	
1835–39 40–44	٠.	5 5	$\begin{array}{c} 2.436 \\ 1.752 \end{array}$	$\begin{array}{c} 1.031 \\ 1.026 \end{array}$	$\begin{array}{c} 41-50 \\ 42-51 \end{array}$	10 10	1.560 $1.510$	$\begin{array}{c} 1.03 \\ 1.03 \end{array}$	
40 <del>-44</del> 45-49	• •	5	1.498	1.026	42-51	10	1.310 $1.412$	1.03	
50-5 <b>4</b>		5	1.309	1.031	44-53	10	1.433	1.03	
55-59		5	1.281	1.033	45-54	10	1.404	1.03	
1830–39		10	2.680	1.026	46-55	10	1.375	1.03	
31 - 40	٠.	10	2.568	1.018	4756	10	1.352	1.03	
32-41	٠.	10	2.443	1.021	48-57	10.	1.325	1.02	
33-42			2.314	1.020	49-58	10	1.308	1.03	
34-43			2.205	1.029	50-59	10	1.295	1.03	
35-44	٠.	10	2.094	1.028	60-69	10	1.233	1.08	
36-45	٠.	10	1.979	1.028	70-79	10	$1.196 \\ 1.209$	1.04	
37-46	• •	10	1.877	$1.026 \\ 1.027$	80-89 90-99	$\begin{array}{c c} 10 \\ 10 \end{array}$	1.147	1.0	
38-47 39-48		10	1.784	1.027	1900-13	13	1.147	1.0	

<sup>&</sup>lt;sup>1</sup> Düsing, Das Geschlechtverhältniss im Königreich Preussen.

This table seems to shew that, on the whole, the masculinity of birth  $\mu_b$  can be expressed approximately by such an equation, for example, as

$$(336)\dots\mu_b = \frac{M_0}{F_0} = 1.06 - 0.0325 \; (\mu_P - 1) + 0.0333 \; (\mu_P - 1)^{\frac{5}{4}};$$

 $\mu_{\rm P}$  denoting the total number of males divided by the total number of females in the population over the period considered. The tabulated mean values of the masculinity of the population, and the position of the curve which represents the formula, are shewn on Fig. 45. The result may, of course, not be *directly* due to the masculinity of the population: both may have varied through some condition itself varying with time. Fig. 46 shews such a variation. This, too, implies an opposite progression; that is, it indicates clearly that while the masculinity of the population was, on the whole, diminishing, that of the birth was, on the whole, increasing.

The results for Victoria point less decisively in the same direction. They are as follows:—

Table XXIV .- Masculinity in Victoria.

Period	 1851-60	1861–70	1871-80	1881-90	18911900
Of Population	 1.765	1.303	1.142	1.108	1.049
Of Births	 1.046	1.047	1.044*	1.049	1.050
	 	\			

<sup>\*</sup> In conflict with the general indication.

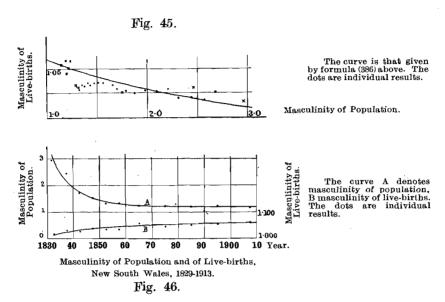
These shew that as the masculinity of the population was diminishing, that of birth was increasing, with the exception of the decennium 1871-1880.

For the Commonwealth of Australia the results for the masculinity of the population at the beginning of a year compared with that of the births in the same year, set out in the order of the masculinities of the population, are:—

Table XXV.--Masculinity in Australia.

						·	
Masculinity	1909	1910	1911	1908	1907	1912	1913
Of Population	1.0764	1.0771	1.0787	1.0793	1.0824	1.0854	1.0885
Of Birth	1.0520	1.0638	1.0473	1.0493	1.0489	1.0454	1.0476

The trends are again in opposite directions, but not markedly.



In the following table is set out the masculinity of the births, and in decreasing order of the population of a number of countries; these give no definite indication:—

Table XXVI.—Masculinity of Various Countries, Arranged in Order of Masculinity of Population.

Country.	Year of Estimation	$egin{array}{ll}  ext{Masculin} \  ext{ity of} \  ext{Population} \  ext{$M$} \; \div \; F \end{array}$	Period for which Determined.	Masculin- ity of all Births.	Masculin- ity of Ex- nuptial Births only
Greece Australia Servia Rumania Italy Belgium France Hungary Netherlands Ireland Finland German Empire Spain Austria Denmark Switzerland England & Wales Sweden Scotland Norway	1889 1907 1890 1889 1881 1890 1891 1890 1890 1887 1890 1888 1891 1890	1.1037 1.0793 1.0548 1.0373 1.0050 .9950 .9930 .9852 .9766 .9713 .9690 .9615 .9615 .9578 .9515 .9461 .9399 .9389 .9330 .9157	1881-85 1901-13 1885-89 1886-90 1887-91 1887-91 1887-91 1887-91 1887-91 1886-90 1886-90 1878-82 1887-91 1885-89 1887-91 1887-91 1887-91 1887-91	1.058 1.045 1.046 1.050 1.055 1.055 1.055 1.052 1.083 1.058 1.048 1.045 1.036	1.059 1.042 1.035 1.034 1.044 1.022 1.029 1.029 1.047 1.048 1.052* 1.047 1.079 1.055 1.050* 1.016 1.044* 1.043 1.059*
Aver.(unweighted)		.9838	<del>-</del> -	1.0568	1.0446

<sup>\*</sup> The mesculinity of ex-nuptial births is greater in these instances than that of all births; in the other instances it is less.

6. Masculinity of still and live nuptial and ex-nuptial births.—J. N. and C. J. Lewis<sup>1</sup> studied the "variations of masculinity under different conditions" in 1906. Omitting seven of their quoted cases, in which the information is incomplete, they shew that still-births disclose a masculinity of 2 to 4 per centum greater than that for live-births. The unweighted averages of their cases with the omission mentioned (see p. 162), viz., 17, give for the masculinity of live-births (M/F), 1.0504, and for that of still-births 1.3032; that is, a masculinity 1.2407 greater than that of live-births. Results have been tabulated for Western Australia for the years 1897 to 1913 for live and still-births, and from 1908-1913 for ex-nuptial and nuptial still and live-births. These give the same general indication. The results are as follows:-

Table XXVII .- Masculinity-ratios for Nuptial, Ex-nuptial and Still-births, Western Australia,\* 1897 to 1913.

	Ī		MASCULINITY.								
		18	1897–1902.			†1902–1907.			1908–1913.		
***		М.	F	M÷F	М.	F.	M÷F	М.	F.	M÷F,	
Nuptial still-								ļ			
Literature			_					804	641	1.254	
Ex-nuptial still-	.							ì			
1・ラモニ		-				_		49	37	1.325	
All still-births		507	373	1.359	672	528	1.273	853	678	1.258	
Ex-nuptial live-											
1.1.10	١. ١	759	687	1.1048	982	884	1.1109	1116	1037	1.0762	
Nuptial live-											
17. (1		15457	14658	1.0545	21226	20108	1.0556	23941	22882	1.0463	
All live-births		16216	15345	1.0508	22208	20992	1.0579	25057		1.0476	
All birthst		16723	15718	1.0639	22880	21520	1.0632	25910	24597	1.0534	
•						Ī					

<sup>\*</sup> See Statistical Register, Western Australia, 1906; p. 12, 1914, Pt. I., p. 14. † 1902 has been included twice in order to have 3 six-year periods. ‡ Including, that is, still-births.

The experience in Australia from 1901 to 1913 gave an unweighted average of the masculinities determined for each year, for all births, and for ex-nuptial births, the following results, viz.:-

Australia All live-births Ex-nuptial births Various Countries All live-births (See Table XXV.) Ex-nuptial births	Masculinity.     Masculinity.       1.0508     1.0411 to 1.00       1.0417     1.0098 to 1.00       1.0568     1.036 to 1.11       1.0446     1.016 to 1.07	338 321 8
------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------

The unweighted average ratio of the "ex-nuptial" to all live-births was 5.954 per centum for Australia.

<sup>&</sup>lt;sup>1</sup> See Journ. Inst. Act., Vol. xl., pp. 154-188, April, 1906.

It was stated by R. Mayo-Smith in his "Statistics and Sociology," that "among illegitimate" (i.e., ex-nuptial) "children the excess of boys is less than among legitimate" (i.e., nuptial). William Farr, however, pointed out in his "Vital Statistics," that he believed that "it is assumed in the French returns that foundling children are illegitimate," but that such an assumption is probably invalid, and he considered the matter to be in doubt. The Australian results, however, tend to confirm those for Europe given in Table XXVI.

7. Coefficients of ex-nuptial and still-birth masculinity.—It is a somewhat remarkable fact that ex-nuptial and still-births shew increased masculinity, and that among still-births the ex-nuptial shew a somewhat different masculinity to the nuptial. For the analysis of this the following notation will be convenient:—

Live male and female births, total 
$$= m + f = b$$
  
,, ,, nuptial  $= m_0 + f_0 = b_0$   
,, ,, ex-nuptial  $= m_1 + f_1 = b_1$   
Still male ,, ,, nuptial  $= m_2 + f_2 = b_2$   
,, ,, ex-nuptial  $= m_3 + f_3 = b_3$   
,, ,, total  $= m' + f' = b'$ 

If we call the ratio of the masculinity in the one case (say the exnuptial) to that in the other (say the nuptial) the masculinity intensification-coefficient k, its significance will vary according as we use  $\mu_1$ ,  $\mu_2$ ,  $\mu_3$ ; see Table XXI. It may easily be shewn that

that is, in regard to any character in the first case it is the relative number of males born divided by the relative number of females born; in the second case it is the relative number of males born divided by the relative number of births; in the third case it is the ratio of the differences of the males and females, divided by the relative number of births. The coefficient intended can be indicated by suffixes and accents; thus the intensification-coefficient of ex-nuptial still-births on total still-births would be  $k_3'$ ; of ex-nuptial on nuptial live-births,  $k_{10}$ ; and so on; see the preceding scheme of notation in the beginning of this section.

<sup>&</sup>lt;sup>1</sup> Macmillan, London, 1895, p. 77. <sup>2</sup> E. Stanford, London, 1885 p. 104.

The coefficients for Western Australia are as in the following table:—
Table XXVIII.—Masculinity Intensification-Coefficients, Western Australia,
1897-1913.

Ratio of Masculinity of	To the Masculinity of	1897-1902	1902–1907	1908–1913
All still-births Ex-nuptial still-births Ex-nuptial live-births	All live-births Ex-nuptial live-births Nuptial live-births	1.293 — 1.049	1.203 	1.201 1.057* 1.029

<sup>\*</sup> Depends upon limited numbers; see Table XXVII.

For Western Australia for 1897 to 1913 inclusive, the ratio of masculinity of all still-births, 1.287, on all live-births, 1.054, is 1.221. This agrees excellently with the result of a series of values for Europe shewn in Table XXVIII., the mean of which is 1.2397.

Table XXIX.—Ratio of Masculinity of Still-Births to that of Live-Births, in various Countries.

	Years.	Ratio.		Years.	Ratio.		Years	Ratio
Paris Paris Livonia Montpellier Alsace-Lorraine Netherlands	8 10 10 	1.157 1.179 1.205 1.208 1.208 1.210	Germany W. Australia Prussia Hungary Italy Amsterdam	5 17 10 5 5	1.220 1.221 1.225 1.238 1.239 1.241	Austria Belgium Switzerland Sweden + Finland Sweden France	5 5 9 	1.249 1.264 1.292 1.299 1.300 1.360
Mean		1.195	Mean		1,231	Mean		1,294

8. Masculinity of First-born.—It has been supposed that masculinity has some relation to primogeniture. For the six years 1908 to 1913 inclusive, there were in Australia 111,545 births, of which 25,708 were first births. The number of males and females gave the following results, viz.:—

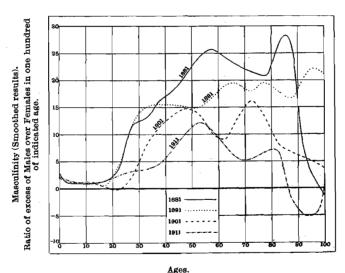
	N.	lasculinity of Austral	ian
Period.	First-births.	Other births.	All births.
1908–1913	1.05260	1.05001	1.05066

Tabulated according to ages between marriage and birth, the results were:=

Period	Masculinity of Australian First-births, the Interval after Marriage being—						
	Under 1 year	l year	2–5 years	5-25 years			
1908–13 Difference from Masculinity of all live-	1.0534	1.0514	1.0578	1.0091			
births for same period, viz., 1.0507	+.0027	+.0007	+.0071	0416			

The numbers, however, are relatively small for the last group, in which there were only 3490 births. The difference between the different groups and the masculinity of all live-births for the whole period is not more remarkable than the difference between the masculinity of all live-births between one year and another. Bertillon's result from 1,140,860 births in Austria was 1.086 for first, and 1.054 for subsequent births; while Geissler's result for Saxony for 4,794,304 births was 1.054. Lewis for Scotland obtained from 85,964 births, for first births, 1.054; for subsequent births, 1.048; Streda for Alsace-Lorraine, from 47,198 births, for first births, 1.058; for subsequent births, 1.059.

9. Masculinity of populations according to age, and its secular fluctuation.—In any country where migration has a large influence, and especially where also the migration is of a somewhat specialised character, the masculinity is likely to shew considerable changes. In the following Table, viz., XXX., are given the masculinities ( $\mu_3$ ) in age-groups, for four Censuses, viz., 1881 to 1911, the masculinities in this case being (M-F)/(M+F). This character is strikingly different from that of England. The significance of the fluctuations of the masculinity are best seen in Fig. 47.



Variation of Masculinity of Australian population according to age.

Fig. 47.

<sup>&</sup>lt;sup>1</sup> See Journ. Inst. Act., vol. xl., 1906, p. 164.

Table XXX.—Masculinity\* in Age-groups at Censuses 1881, 1891, 1901, 1911,
Australian Commonwealth, and England, 1911. Computed from Smoothed
Results.

Age-		Australi	an Commonv	VEALTH,	England.
GROUP.	1881.	1891.	1901.	1911.	1911.
0-4	.01018	.01374	.01227	.01588	+.00463
5–9	.00898	.00975	.01105	.01064	00060
10–14	.00943	.01195	.00981	.00869	00126
15–19	.01332	.00389	.00223	.01485	00804
20-24	.03493	.04192	.00157	.02472	05366
25-29	.12482	.11802	.02183	.03155	05440
30-34	.12489	.15534	.07807	.03485	04359
35–39	.15176	.14833	.11272	.04356	03459
40–44	.17886	.16100	.13292	.07038	03693
45-49	.20734	.14761	.14744	.10160	03811
50-54	.24498	.15267	.13833	.12294	04132
<b>55–59</b>	.25546	.16233	.10217	.10885	04883
60–64	.23988	.19446	.08809	.07725	06437
65–69	.22504	.19310	.13194	.05274	09299
70-74	.22228	.17717	.16770	.05417	14419
75–79	.20038	.19886	.13247	.06685	17745
80–84	.26350	.17799	.07707	.07253	21752
85–99	.28955	.12313	.06902	02107	27160
90-94	.03175	.25424	.05306	05164	35311
95–99	05263	.23967	.06215	04651	40237
100	+.20000	.17647		+.05263	43750
Masculinity of total Population	.07983	.07362	.04824	.03840	03269

<sup>\* (</sup>Males - Females) : Persons.

An examination of these results shews that where there is a considerable migration element, predictions as to the future movement of the masculinity, by extrapolation, are somewhat uncertain both for any age-group and for all ages. Moreover, interpolations will lead to results which can be regarded only as fairly accurate.

10. Theories of Masculinity.—The results given shew that the masculinity of still-births is considerably higher than that of live-births, roughly in the proportion of about 1.15 to about 1.35 greater; and that masculinity at birth generally is about 1.05 or 1.06. These facts are remarkable, and have given rise to various attempted explanations. J. A. Thomson in his "Heredity" says that, according to Blumenbach, Drelincourt in the 18th century brought together 262 groundless hypotheses as to the determination of sex, and that Blumenbach regarded

<sup>&</sup>lt;sup>1</sup> Murray, London, 1908, p. 477.

Drelincourt's theory as being the 263rd. Blumenbach postulated a "Bildungstrieb" (formative impulse), but this was regarded as equally groundless. It has been suggested that war, cholera, epidemics, famine, etc., are followed by increase in the masculinity. These will have to form the subject of later investigations. At present it would seem that the first necessity is a sufficiently large accumulation of accurate statistic, as a basis for study. The one point which is clear is that death *in utero* (at least in the later stages) is marked by much greater masculinity than that which characterises live-births. This will be referred to later in dealing with infantile mortality.

That the effect of war is not apparently discernible in existing statistics, is evident from the following table, viz., Table XXXI, shewing the experience of France from 1865 to 1876. It will be seen that the waryears, 1870 and 1871, and subsequent years reveal no change in the masculinity.

Table XXXI.—Experience of France, 1865 to 1876.

Year.		Rates per l	000 of Mean	Deaths of Children under 1 year	Excess of Males over Females in	
		Marriage.	Birth.	Death.	of age per 1000 births.	each 1000 births.
1865		7.85	26.5	24.3	191	2.5
1866		8.00	26.4	23.2	162	2.6
1867		7.85	26.4	22.7	170	2.1
1868		7.85	25.7	24.1	192	2.3
1869	• •	8.25	25.7	23.5	176	2.4
1870		6.05	25.5	28.4	191	2.3
1871	• •	7.25	22.9	35.1	240	2.4
1872		9.75	26.7	22.0	152	2.3
1873		8.85	26.0	23.3	180 -	2.4
1874		8.30	26.2	21.4	158	2.6
1875		8.20	25.9	23.0	170	2.4
1876		7.90	26.2	22.6	165	2.3

## XI.—NATALITY.

1. General.—The phenomena of human reproduction, as affecting population, and the whole system of relations involved therein, may be subsumed under the term "natality." In one aspect they measure the reproductive effort of a population; in another they disclose the rate at which losses by death are made good; in a third they focus attention upon social phenomena of high importance (e.g., nuptial and ex-nuptial natality); in yet another they bring to light the mode of the reproductive effort (e.g., the varying of fecundity with age, the fluctuation of the frequency of multiple-birth, etc.) In this section we shall deal with the questions which relate more directly to birth-rate, and shall treat of those which relate more directly to nuptiality in section XIII, and to fecundity in section XIII.

Birth-rates are not immediately comparable. The physical and social development of two communities being identical, their birth-rates become roughly comparable only when the relative numbers of married and of single women at each age are identical. In regard to the initial qualification, it may be pointed out that any of the races of Western Europe, for example, may be immediately compared on the basis of identical numbers at the same ages; but a population of the natives of India would not be comparable to one of Western Europe because of earlier physical development and earlier marriage. Comparisons of this special character, however, may sometimes be founded on principles indicated by the theory of "corresponding states" in physical investigations. This matter will be referred to later.

Populations similarly characterised in respect of features, material to any question at issue, may be called homogeneous in that respect. In order to compare the birth-rates of populations, otherwise homogeneous, but differently constituted in regard to age, it is necessary to take account at least of three things, viz., (i.) the numbers at each age; (ii.) the relative fecundity at each age; and (iii.) the relative numbers of married and single women. In other words, a convenient and strict comparison can be made satisfactorily only on the basis of what may be called a "standard" or "normal" female population, This normal population should represent the mean of the whole series of populations proposed to be compared (i.e., the relative numbers of married and of single females at each age should be their ratio to the entire aggregate). Comparison is then effected by attributing to this population-norm the nuptial and exnuptial birth-rates actually existing in the populations to be compared with one another. Such a comparison is free from the effect of accidental differences in constitution as to age; thus the relative magnitude

of the birth-rates and populations compared are revealed. The principles of developing norms of this type have already been considered; see VIII., §§ 8 to 12.

We consider first the nature of a birth-rate.

2. **Crude birth-rates.**—While the total number born in any population during any period, divided by the average number of the population during the period, *i.e.*, the *crude birth-rate*, is one element of the rate at which the population is reconstituted, its nature and limitations are important from certain points of view. We propose to consider these. Since both births and population vary with time, we may regard their variations of rate as represented by the functions f(t) and F(t). Thus if  $B_m$  denote the number of births occurring in a unit period (say 1 year), and  $P_m$  be the mean population during that period, the average periodrate (annual rate in the case supposed), which may appropriately be referred to the middle of the period, is:—

the instantaneous value passing through the range of values which determine the form of the functions f and F. P is the population as at the middle of the year, and B the rate per annum at which births are occurring at that moment.

In general, no serious error will be introduced in the value of  $\beta$  if, instead of  $P_m$ , the population at the middle of the year is used, though more accurate results will be to hand if population-determinations at the end of each half-year, or each quarter, or better still each month, are used to ascertain the mean. The necessary formulæ would be respectively

$$(341)...P_{m} = \frac{1}{2}(P_{0} + P_{1}); \text{ or } = \frac{1}{6} (P_{0} + 4P_{\frac{1}{2}} + P_{1}); \text{ or }$$

$$= \frac{1}{12} (P_{0} + 4P_{\frac{1}{2}} + 2P_{\frac{1}{2}} + 4P_{\frac{3}{2}} + P_{1}); \text{ or }$$

$$= \frac{1}{24} (P_{0} + 2P_{\frac{1}{12}} + 2P_{\frac{3}{2}} + \dots \cdot 2P_{\frac{13}{2}} + P_{1}; \text{ or }$$

$$= \frac{1}{40} \{ (P_{0} + P_{\frac{3}{2}} + P_{\frac{3}{2}} + P_{\frac{13}{2}} + P_{1}) + 2P_{\frac{3}{2}} + F_{\frac{3}{2}} ny of these indicated in VI., § 2, Table VI.

¹ The question of the formulae to be preferred was discussed for quarterly results in the Population and Vital Statistics Bulletin for Australia, No. 1, pp. 20, 21, and the coefficients adopted were 1, 4, 2, 4, 1, though previously 1, 2, 2, 2, 1 had been used. The use of formulae based upon integral functions supposes that the recorded population at the moment of record is substantially free from large deviations from the number represented by the functional change. If the functional change is small, and the "accidental" deviation is large, the use of the functional formulae does not yield the advantages expected, and has the disadvantage of multiplying the "accidental" deviation possibly by a very large or a very small factor (as the case may be); if the former, the result is not satisfactory.

Such formulae are, of course, more than abundantly accurate for all statistical purposes.

Birth-rate is influenced by-

- (a) the sex and age constitution of the population;
- (b) all forces restricting the fecundity of a population (e.g., frequency of, and the age of, marriage; social tradition and habits; etc.);
- (c) the frequency of multiple-births;
- (d) infantile mortality (since mothers who lose their offspring are again exposed to the risk of maternity), etc.

These influencing factors will be considered either in this section, viz., XII., or in later sections.

3. Influence of the births upon the birth-rate itself.—Let it be supposed that the population of two communities be initially P and that in the same period B births occur in one and 2 B in the other, of which in each case the proportion s survive; the numbers being thus sB and 2sBat the end of the period. If there were no migration, and no deaths, other than those arising from the births, the deduced birth-rates would be

$$(342)..eta_1 = rac{B}{P \,+ rac{1}{2}\,sB} \;\; ext{and} \;\; eta_2 \;= rac{2\,B}{P \,+ sB} \;\; ; \; ext{but} \; 2eta_1 = rac{2\,B}{P \,+ rac{1}{2}\,sB}$$

a larger quantity. Hence the effect of an increase of a birth-rate, when a proportion of the births is incorporated in the population, is to somewhat diminish that ratio of births to population, which really represents the relative frequency of birth, unless at least the population is increasing in some manner which counteracts this. The preceding result is more obvious if put in the form-

$$(342a)...2eta_1 = rac{2\,B}{P\,+\,s\,B}\,\{1+rac{1}{2}\,\,s\,rac{B}{P}-rac{1}{4}\left(srac{B}{P}
ight)^2\,+\, ext{etc.}\}\;;\;eta_2 = rac{2\,B}{P\,+\,s\,B}$$

More generally we have—
$$(342b) \dots \beta_1 : \beta_2 :: \frac{B_1}{P_1 (1 + \frac{1}{2}r_1)} : \frac{B_2}{P_2 (1 + \frac{1}{2}r_2)}$$

(r denoting the increase, supposed linear); shewing that the birthrates and births are in the same ratio only if the mean populations are identical. Hence as measures of fecundity birth-rates need some slight correction, owing to their influence on the magnitude of the population. They are strictly comparable in this respect only when two populations are homogeneous, and differences of birth-rate themselves disturb the homogeneity and thus involve the application of some correction. 1

$$i = I / \{ \frac{1}{2} (A + B) - \frac{1}{2} I \}$$

 $<sup>^{1}</sup>$ There is an analogous case in connection with the computation of interest earned on assurance and similar funds. Thus if I denote the interest earned in the course of a year, A and B the funds at the beginning and end of the year respectively, and i the effective rate of interest earned on the funds during the course of the year, then the value of i is approximately given by the following formula, now generally adopted in practice:

4. Influence of infantile mortality on birth-rate.—Denoting the number of births by B, and of infantile deaths by M, and the number of women of child-bearing age by P, we shall have for the birth-rate  $\beta$ , attributed not to the whole population but to the P women, and for  $\mu$  the rate of infantile mortality—

$$(343).....\beta = B/P; \mu = M/B; \beta\mu = M/P.$$

Suppose  $\mu$  to change to some other value  $\mu' = M'/B'$ ; M' being the number of deaths and B' the number of births under the changed state of things, assumed to have become constant. Then, since mothers who lose their children are exposed to an increased risk of maternity, the ratio of which is only the proportion q (a proper fraction) of the full risk, we shall have for the number at risk as originally, viz., N, and also after a change in the prevailing rate of infantile mortality, N'.

$$(344)....N = P - B + qM$$
; and  $N' = P - B' + qM'$ .

If the reproductivity of these two groups is the same, then B/N = B'/N'; from which it follows that—

$$(345)......\frac{P+qM}{B}-1=\frac{P+qM'}{B'}-1$$

and consequently, discarding the unit from each side and writing in the values of the quantities as by (343) above, we have—

$$(346)......\frac{1}{\beta} + q\mu = \frac{1}{\beta'} + q\mu';$$

that is-

$$(347)\ldots\beta'=\beta\{1+q\beta'(\mu'-\mu)\}$$

It will be found that this change is sensibly a linear one, or any increment in the rates of mortality will cause a sensibly constant but small proportional increase in the birth-rate. If we call the birth-rate, freed from the influence of infantile mortality, the *normal birth-rate*  $\beta_0$ , then—

$$(348).....\beta_0 = \beta (1 + k\mu).$$

in which k may be regarded as a constant for a particular community, and a particular epoch. The value of k was found on the average for Europe to be about + 0.033  $\mu$ , or  $\beta_0 = \beta +$  0.033  $\mu$ , the birth-rate  $\beta$  being expressed per 1000 of the population, and the infantile mortality rate  $\mu$  expressed per 1000 births. An examination of the data for different countries gave the following results:—

TABLE XXXII.—Influence of the Rate of Infantile Mortality on the Crude Birth-rate for Various Countries, about Year 1900.

COUNTRY.	PER	IOD.	Value of $\beta_0$ and $k$ in $\beta = \beta_0 + k\mu$ .		
	Birth.	Mortality.			
			$\mathcal{E}_{0}$	k	
New Zealand $\dots$	1881-1905	188 <b>2</b> –1906	13.2	+ 0.19	
Commonwealth	1887–1905	1888-1906	16.8	+ 0.11	
Sweden	1881-1904	1882-1905	17.1	+ 0.10	
Norway	1881-1905	1882-1906	20.5	+ 0.10	
Prussia	1881-1905	188 <b>2</b> –1906	19.1	+ 0.08	
Various Countries*	1901	1902	19.4	- - 0.08	
Netherlands $\dots$	1881-1905	1882-1906	22.6	+ 0.06	
France	1881-1905	1882-1906	12.7	+ 0.06	
Denmark	1881-1905	1882-1906	22.4	+ 0.06	
Japan	1881-1904	1882-1905	22.3	+ 0.05	
Cevlon	1881-1905	1882-1906	26.4	+ 0.04	
Jamaica	1001 1005	1882 - 1906	34.3	+ 0.02	
Switzerland	1001 1004	1882-1905	25.3	+ 0.01	
Ireland	1001 1005	1882-1906	25.8	- 0.02	
England and Wales	1001 1007	1882-1906	38.6	0.08	
Scotland	1901 1005	1882-1906	38.9	- 0.06	

\* For one year only. † The birth-rate being expressed per 1000 of the population, and the infantile mortality per 1000 births.

The infantile mortality rate  $(\mu)$  in the table is expressed by the number of infants dying per 1000 of infants born.

The crude birth-rate ( $\beta$ ) is the number of births per 1000 of the total population.

It will be seen that the magnitudes of k, and therefore of q, have no general relation to the magnitude of the birth-rate; that is, a particular value of the risk-factor is characteristic of a particular country.

In an investigation made in 19081 it was shewn that the influence of infantile mortality was very irregular in its operation, and the following deductions were stated, viz. :--2

- (i.) When either all mothers of deceased infants, or any constant proportion thereof, may be regarded as subject to equal risk of fecundity (i.e., equally likely to bear children) then equal increases in the rate of infantile mortality tend to be followed by equal though relatively small increases in the birth-rate.
- (ii.) The influence of infantile mortality on the birth-rate must always be very small. (The contrary proposition is not, of course, necessarily true).

This type of investigation aims rather at ascertaining the form of the function expressing the correction, so that the form being determined, the constants can then be ascertained from the data. It would appear that yearly irregularities of birth-rate are so great as compared with the influence of infantile mortality that the latter is virtually masked by the former. Probably in any rigorous investigation of a measure of the fecundity of a population the birth-rate should be corrected in some such way as has been indicated.

<sup>&</sup>lt;sup>1</sup> By the writer. See Journ. Roy. Soc., N.S.W., Vol. xlii., pp. 238-250, particularly Fig. 1 on p. 243 therein.

<sup>&</sup>lt;sup>2</sup> Loc. cit. pp. 241-2.

5. World-relation between infantile mortality and birth-rate.—In order to ascertain whether in a world-wide survey of infantile mortality and birth-rates any correlation manifested itself we may extend the purview of all countries where fairly accurate statistics are available, viz., the following:—

Australia, Austria, Belgium, Chili, Ceylon, Denmark, England and Wales, France, Ireland, Italy, Jamaica, Japan, Netherlands, New South Wales, New Zealand, Norway, Queensland, Russia, Scotland, South Australia, Spain, Sweden, Switzerland, Tasmania, Victoria, West Australia.

The populations are, of course, repeated with different rates, and are equivalent to 8776 millions, the results forming groups of available results; according to the magnitude of the infantile mortality we get the results shewn in Table XXXIII. hereunder, the ranges of infantile mortality being shewn therein.

In Fig. 48, graph A denotes the relative frequency of the given ranges of infantile mortality.<sup>3</sup> It will be observed that the graph is dimorphic, that is, that while the characteristic rate of infantile mortality is about .0150 (150 as usually expressed), there is also a second mode for the rate of about .0255. The corresponding crude birth-rates are about .029 and .048 respectively (or residual birth-rates, see hereinafter, about .025 and .035). It will be seen that there can be a very high rate of infantile mortality with low birth-rate, but it would appear, only for very limited populations.<sup>4</sup>

TABLE XXXIII.—Relations of Infantile Mortality and Birth-rate, various Countries, about Year 1900.

Popula- tion Re- presented (millions)	Ranges of Infantile Mortality for Individual Populations.	Mean of Infantile Mortalities.	Mean of Crude Birth-rates.	Infantile Mortality of Aggregate.	Crude Birth-rate of Aggregate.	Residual of
344	.06880959	.0821	.0291	.0911	.02692	.02447
479	.10181232	.1120	.0291	.1119	.02889	.02566
2035	.12761474	.1371	.0288	.1387	.02865	.02468
2172	.15191724	.1618	.0291	.1598	.02904	.02440
1116	.17621974	.1872	.0340	.1880	.03391	.02753,
851	.20322179	.2098	.0367	.2085	.03365	.02663
297	22132372	.2286	.0380	.2279	.03808	.02940
696	.2406 – .2559	.2490	.0480	.2491	.04757	.03572
668	.26012771	2688	.0479	.2710	.04763	.03472
189	.28002920	.2870	.0446	.2845	.04885	.03495
105	.30403290	.3133	.0385	.3075	.04549	.03150
147	.33253490	.3406	.0366	.3392	.03701	.02446
91	.36604120	.3890	.0372	.3800	.03681	.02282

<sup>&</sup>lt;sup>1</sup> The method is, of course, not perfectly satisfactory; for, as pointed out by the writer (on p. 245), loc. cit. the populations are not homogeneous, and doubtless if more moderate-sized districts could be analysed the material would give a clearer indication of the true nature of the relation.

<sup>&</sup>lt;sup>2</sup> See also loc. cit., p. 246, and Fig. 2, p. 247, in the same paper.

<sup>3</sup> See page 150 hereinafter.

<sup>4</sup> Similar indications are given by the analysis before referred to. See loc. cit. p. 248, Fig. 3.

This more general result shews that propositions (i.) and (ii.) in the preceding section can be regarded as true only for individual populations and probably for very limited periods of time; the effects are readily masked by more potent influences.

In the table hereunder (XXXIV.), of results in the present century, the following countries have been included, viz., in column (i.) New Zealand, 1913; Norway, 1912; Australia, 1913; Sweden, 1911; France, 1912; Netherlands and Denmark, 1913; Switzerland, 1913; Ireland, England and Wales, and United Kingdom, 1913; Finland, 1912; Scotland and Ontario, 1913; Belgium, Italy and Prussia, 1912; Serbia, 1911; German Empire, 1912; Spain, 1907; Bulgaria and Japan, 1910; Jamaica, 1913; Austria and Hungary, 1912; Ceylon and Roumania, 1913; Russia (European), 1909; Chile, 1911; and in column (iv.) France and Belgium, 1912; Ireland, England and Wales, and Ontario, 1913; Sweden, 1911; United Kingdom, 1913; Switzerland, 1912; Scotland and Denmark, 1913; Norway, 1912; New Zealand, Netherlands, and Australia, 1913; German Empire, Prussia, Finland, Austria and Italy, 1912; Spain, 1907; Japan, 1910; Jamaica, 1913; Serbia, 1911; Hungary, 1912; Chile, 1911; Ceylon, 1913; Bulgaria, 1910; Roumania, 1913; Russia (European), 1909. The results are the weighted means (or what is the same thing, the values are for the populationaggregates) of the populations, combined in successive groups of ten, arranged (in ascending order) according to infantile mortality in the one ease, and according to birth-rate in the other.

These results shew unequivocally that there is, in general, a relation between birth-rate and infantile mortality. The calculated results are as follows;  $\beta$  denoting birth-rate per unit of population, and  $\mu$  denoting infantile mortality rate per birth:—

Determined from groupings in the order of infantile mortality:—

$$(349)$$
.  $\beta = 0.00956 + 0.1405 \mu$ ; (which gives  $\mu = 0.06804 + 7.117 \beta$ );

and determined from grouping in the order of birth-rate :-

$$(350)\dots\mu = -0.03661 + 5.970\,\beta$$
; (which gives  $\beta = 0.06132 + 0.1675\mu$ ).

The mean of these results is expressed with sufficient precision by-

(351). 
$$\beta = 0.00785 (1 + 19.6 \mu); \mu = 0.0510 (1 - 127 \beta)$$

 $\beta$  being the rate per unit of population, and  $\mu$  per birth.

TABLE XXXIV.—General Relation between Infantile Mortality and Birth-rate,

Aggregates of various Countries, 1907 to 1913.

Infant	Infantile Mortality and Birth-rate,					-RATE AN	D INFAN	TILE MOI	RTALITY
Popula- tion in Mil- lions.	Infan- tile Mor- tality.*	Birth- rate.†	Calcul- ated.‡	Re- duced Birth- rate.†	Popu- tion in Mil- lions.	Birth- rate.†	Infan- tile Mor- tality.*	Calculated.§	Re- duced Birth- rate.*
(i.)	(ii.)	(ii	i.)		(iv.)	(v.)	(7	7i.)	
107.6	<b>`90</b> '	22.6	22.2	20.6	154.2	22.7	99 `	99	20.5
152.5	96	23.0	23.1	20.8	116.9	24.0	105	107	21.5
153.3	96	23.1	23.1	20.9	110.4	24.1	104	107	21.6
153.2	97	23.0	23.2	20.8	112.2	24.4	103	109	21.9
150.4	99	23.0	23.5	20.7	80.1	24.8	99	111	22.3
118.3	107	24.3	24.6	21.7	143.5	26.4	121	121	23.2
147.2	113	26.1	25.4	23.2	179.1	27.1	128	125	23.6
185.4	121	26.7	26.6	23.5	136.2	28.2	134	142	24.4
184.5	122	26.9	26.7	23.6	161.3	28.8	144	135	24.7
246.3	129	27.3	27.7	23.8	191.6	29.6	142	140	25.4
228.6	135	28.4	28.5	24.6	208.0	30.0	144	132	25.7
186.9	142	29.8	29.5	25,6	256.1	30.8	148	147	26.2
234.2	146	30.7	30.1	26,2	255.9	30.8	148	147	26.2
230.4	147	30.8	30.2	26.3	252.7	31.0	150	148	26.4
256.6	151	31.0	30.8	26.3	269.0	31.4	154	151	26.6
270.1	155	31.6	31.3	26.7	206.3	32.5	159	157	27.3
239.3	159	31.6	31.9	26.6	169.5	33.6	163	164	28.1
205.6	163	32.5	32.5	27.2	170.6	33.9	164	166	28.3
319.2	194	36.7	36.8	29.6	149.1	34.8	163	171	29.1
256.5	208	38.9	38.8	30.8	230.6	39.8	211	201	31.4

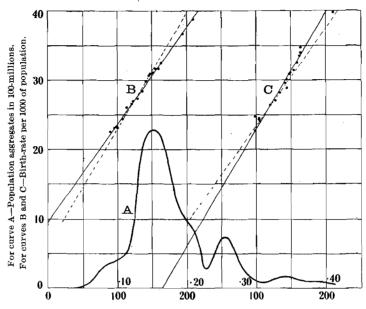
<sup>\*</sup> Per 1000 births.

From these the lines B and C respectively are plotted and the calculated values in columns (iii.) and (vi.) are computed. The dotted lines shew the positions of the other graph for the purpose of comparison, and the line which represents formula (351) is between the two.

That these results, though not identical, are very similar, is seen from the graphs B and C, shewing the two series of values. What they establish is that, on the whole, the birth-rate and infantile mortality increase together. Moreover, when the birth-rate is reduced to its effective value twelve months later (that is, for one year of age), it is much more uniform on the whole. Since, as shewn, the increase of risk of maternity is relatively small (348), it follows that, on the whole, the social conditions which characterise a large birth-rate are those associated with a high rate of infantile mortality. This, of course, is not necessarily so, but expresses the general fact. In short, a high birth-rate is usually associated with a high rate of infantile mortality, but high infantile mortality will, per se, not appreciably affect the birth-rate. The importance of this result is obvious.

<sup>†</sup> Per 1000 population. § By formula (350).

## GENERAL RELATION BETWEEN INFANTILE MORTALITY AND BIRTH-RATE.



For curve A.—Infantile mortality rate per birth.

For curves B and C.—Infantile mortality rate per 1000 births.

6. Residual birth-rates.—Owing to the very high death-rate of infants, the crude birth-rate, taken alone, is not a satisfactory expression of the effective recuperative force of a population against the ravages of death. It is not practicable, however, to assign any particular age as specially appropriate for estimating the virtual efficiency of birth-rate, and as we have seen high birth-rates, however, are ordinarily associated with a high rate of infantile mortality.

For example, New Zealand and Australia had birth-rates in 1912 of 26.5 and 28.7 per thousand population, and *infantile death-rates* (i.e., deaths under 12 months per 1000 born) of 51 and 72, while Ceylon and Chile, in 1911, had birth-rates of 37.9 and 38.5, and infantile death-rates of 218 and 332. This question will be referred to later.

Birth-rates corrected so as to represent the number living after a given period may be called residual birth-rates, and the quantity multiplied into a birth-rate to give its residual value may be called the survival coefficient, or survival factor. We shall consider these. Owing to the fact that of all the deaths which occur in 12 months, about 42 per cent. occur in the first month, the infantile mortality may be referred to the same calendar year as the births without sensible error, or we may correct

it as explained hereinafter. Let  $\beta$  be the birth-rate and  $\gamma$  the rate of infantile mortality, the first expressed per unit of the population, the latter per birth. Then the residual birth-rate  $\beta_r$  is in the residual birth-rate  $\beta_r$  is in the second of the population of the population.

$$(352).....\beta_r = \beta (1 - \gamma)$$

The quantity in brackets is the "survival-factor" and  $\beta_r$  is the "residual birth-rate." For a population in which the number of births was constant and the rate of mortality for the first twelve months was constant, the probability of persons of age 0 living to age 1, viz.,  $_0p_1$ , would be the same as the survival factor, since under these conditions it would denote the ratio of those surviving one year, viz.,  $l_1$  to the number born, viz.,  $l_0$ . Consequently, subject to this limitation—

$$(353)....(1-\gamma) = {}_{0}p_{1} = l_{1} / l_{0}.$$

For a population in which the number of births is increasing, say, at the rate rt, and the rate of infantile mortality diminishing, 2 say, at the rate r't, these quantities become functions of time and are affected by the interval of time between the year for which the births are recorded and the somewhat later year for which the infantile deaths ought to be recorded, in order to properly refer to the birth-group. As, however, the error arising is of a small order as compared with the accidental deviations from year to year, it is questionable whether a correction is worth applying. It may be mentioned that in Australia it was found by an investigation for the years 1909 and 1910, that all children who die in the first year of life live on the average 99.3 days, and children are registered on the average 38.2 days after birth.3 The difference, 61.1 days, or say two months, is regarded as the difference between the years. Thus the infantile mortality in the following table was calculated on the births occurring one-sixth of a year earlier. Similarly the birth-rate given for the equivalent year to n, say  $\beta_{e}$  is—

$$(354)\ldots\beta_{\mathbf{e}} = \frac{1}{6} \dot{\beta}_{\mathbf{n}-1} + \frac{5}{6} \beta_{\mathbf{n}}.$$

It may also be noted that an investigation of the question shewed that of the deaths in Australia under 1 year of age occurring in any calendar year, 0.72 to 0.74 per cent.—average about 0.73—arose from births which occurred within that calendar year, and 0.27 from those which occurred in the preceding year. This proportion is doubtless approximately true also for other countries.

<sup>&</sup>lt;sup>1</sup> These rates are commonly expressed per 1000 of the population, and per 1000 born respectively, in which case the formulæ will be  $\beta_{\rm r}'=\beta'$  (1  $-\frac{\gamma'}{1000}$ );  $\beta'$  and  $\gamma$  being 1000 times greater than  $\beta$  and  $\gamma$ .

<sup>&</sup>lt;sup>2</sup> Infantile mortality has for years past been steadily diminishing in many countries.

<sup>3</sup> This has ceased to be true because of the " maternity bonus."

This would suggest that the coefficients in the above equation (354), should be  $\frac{1}{4}$  and  $\frac{3}{4}$  instead of  $\frac{1}{6}$  and  $\frac{5}{6}$ , but, only if the average lateness of the registration of births and deaths were the same, which, however, was not the case. The practical result of the difference is not great. It will appear from a rigorous investigation in the next two sections, that with the rate of infantile mortality as it stood during the years 1909 to 1913, the proper proportion is about 0.731, a proportion which will be modified only by the difference in the registration interval. This interval, owing to the payment of the maternity bonus, resulting in earlier registration of births, has now become smaller.

TABLE XXXV.—Residual Birth-rates, Australia, 1904-14.

Year.		Crude Birth-rate, for Calendar Year.*	irth-rate, Death-rate† r Calendar Calendar		Survival Factor.	Residual Birth-rate
1903	٠.	25.29				
904	٠.	26.41	81.77	26.073	.91823	23.94
1905	٠.	26.23	81.76	26.260	.91824	24.11
906	٠.	26.57	83.26	26.497	.91674	24.29
1907	٠.	26.76	81.06	26.728	.91894	24.61
1908	٠.	26.59	77.78	26.618	.92222	24.54
1909	٠.	26.69	71.58	26.673	.92842	24.76
1910	٠.	26.73	74.81	26.723	.92519	24.72
911	٠.	27.21	68.49	27.297	.93151	25.43
912	٠.	28.65	71.74	28.410	.92826	26.37
913		28.25	72.71	28.317	92729	26.26
1914		28.05	71.47	28.083	.92853	26.08

<sup>\*</sup> Per 1000 population.

The final column is the efficient birth-rate, the end of the first year of life being taken as an appropriate point of time for determining the efficiency, since the larger death toll from infantile troubles may be regarded as then past.

7. Determination of proportion of infantile deaths arising from births in the year of record, number of births constant.—Births, and infantile and other deaths, are recorded as occurring during successive equal periods of time, usually calendar years, half-years, quarters, months, etc.; and the deaths during such periods are distributed according to a series of age-limits, for adults usually whole years, 0-1, 1-2, etc. In the case of "infantile deaths" or deaths of children under one year of age, they are distributed according to age-limits of weeks, months, quarters, etc. Consequently the infantile deaths occurring in any year are drawn from the births [and immigrants] both in the year of record

<sup>†</sup> Per 1000 births.

and in the previous year. More generally deaths of persons between the ages  $x_1$ , and  $x_2$  recorded in any period of time, say  $-t_z$  to 0, are drawn [where there is no immigration] from those born [in the country] during the period  $-(x_2+t_z)$  to  $-(x_1+0)$ . In the same way deaths recorded in any period  $-t_{2z}$  to  $-t_z$  would be drawn from those born [either in the country or from migrants entering it] during the period  $-(x_2+t_{2z})$  to  $-(x_1+t_z)$ .

If the frequency of births be denoted by k'  $F_1$  (t), the number of survivors after any period of time, x, of persons born at the moment t, will, so long as the death rates at each age remain constant, also be this function multiplied by the probability of surviving to the age x. Thus if this probability be denoted by  $\lambda_x$ , or that of dying be denoted by  $\delta_x$ , = 1  $-\lambda_x$ , then the survivors of age x, say  $S_x$ , and those who have not attained that age, say  $D_x$ , will be—

$$(355).....S_x = \lambda_x F_1(t)$$
; and  $D_x = \delta_x F_1(t)$ 

for we may make k' = 1 if ratios only are needed.<sup>2</sup>

With births increasing, the successive records of the dying of any given age will also shew a similar progressive increase, proportional to that of the births, the death-rates at each age being constant. Thus the aggregate of births between the times  $t_1$  and  $t_2$ , will be—

$$(356)...._{t_1}B_{t_2} = k \int_{t_1}^{t_2} F_1(t) dt.$$

which would give merely B = K ( $t_2 - t_1$ ) if the frequency of births were constant, K being the number per annum when t is expressed in years. If the frequency be not constant, but of the form indicated hereinafter, viz., that in equation (359), then it will be [see also II., §6, (10)]—

$$(357)..._{t_1}B_{t_2} = K (t_2 - t_1) \left\{ 1 + \frac{1}{2} a (t_2 - t_1) + \frac{1}{3} b (t_2^2 + t_2 t_1 + t_1^2) + \frac{1}{4} c (t_2 + t_1) (t_2^2 + t_1^2) + \text{etc.} \right\}$$

which, when  $t_1$  is 0, takes the simpler form—

$$(358)...._0B_t = Kt \left\{1 + \frac{1}{2}at + \frac{1}{3}bt^2 + \frac{1}{4}ct^3 + \text{etc.}\right\}$$

<sup>&</sup>lt;sup>1</sup> The words in square brackets may be omitted, if proper care be taken in the practical computations in regard to the influence of migration.

<sup>&</sup>lt;sup>2</sup> That is  $\lambda_x = l_x/l_0$  in an "actuarial population"; or is  $l_x$  if  $l_0$  be made unity. Similarly  $\delta_x = (l_0 - l_x)/l_0$ .

With respect to survivors to age x, it may be noted that, in the earliest stages of life,  $\lambda_x$  decreases with the greatest rapidity, hence of the deaths occurring in any year the greatest number is contributed by those of the smallest age; at least in the case of all aged less than 10 or 11 years, and therefore for ages less than 10 years the greater number is contributed by what may be called the *ordinary year of reference*, viz., in the case of infantile deaths, the year of observation [or year of record] itself. We may obtain an exact measure of this if we have the values of  $\lambda_x$  or  $\delta_x$ . For perfect rigour we must put these quantities  $F_2(x, t)$  for at the present time the value  $\lambda_x$  is sensibly increasing every year, and thus  $\delta_x$  decreasing every year, for nearly all ages. It will, however, simplify the solution, and lead to no sensible error, if we omit the t and assume that either quantity is simply a function of x, say  $\lambda_x = F_2(x)$  and  $\delta_x = F_3(x)$ .

Before envisaging the pertinent questions in their practical form, rather than in their more general and theoretical form, it may be pointed out that both these probabilities may readily be expressed as the sum of a series of exponential terms in the form (360) hereunder. Moreover, as has already been shewn, see II., §§ 2 to 10, formula (2a), (6), (9) to (13), the birth-frequency [and if desired this may include the migration element], may be put in the form—

$$(359)....b_t = F_1(t) = K(1 + at + bt^2 + ... \text{etc.})$$

in which a, b, c, etc., may of course be positive, negative, or zero. As above-stated, either—

$$(360)...\lambda_x$$
, or  $\delta_x = F_2(x)$  or  $F_3(x) = (k_1 e^{-n_1 x} + k_2 e^{-n_2 x} + \text{etc.})$ 

in which, for values of x not greater than 10 or 11, n is numerically a diminishing quantity. On expanding the exponential terms we have—

$$(361)$$
.... $\lambda_x$  or  $\delta_x = A (1 - \alpha x + \beta x^2 - \text{etc.})$ 

in which it may be easily seen that-

<sup>&</sup>lt;sup>1</sup> The instantaneous rate of mortality, or the so-called "force of mortality" in actuarial terminology, is, in Australia, a minimum between the ages 11 and 12 years of age for males, and between 10 and 11 for females.

<sup>&</sup>lt;sup>2</sup> The "ordinary" rate of infantile mortality is the ratio of the number of infants dying under one year of age, in any year of observation, to the number of infants born in the same year. This ratio is usually multiplied by 1,000, to avoid decimals.

$$(362)....A = \Sigma k; \quad \alpha = \frac{\Sigma(kn)}{\Sigma k \cdot 1!}; \quad \beta = \frac{\Sigma(kn^2)}{\Sigma k \cdot 2!}; \quad \text{etc.}$$

Incidentally, it may be repeated that the function  $b_t$  may be made to embody all complications arising from migration, forasmuch as birth may be regarded mathematically, merely as a case of immigration at age 0, and the constant can be so determined as to represent birth and [net] immigration combined for a succession of ages.

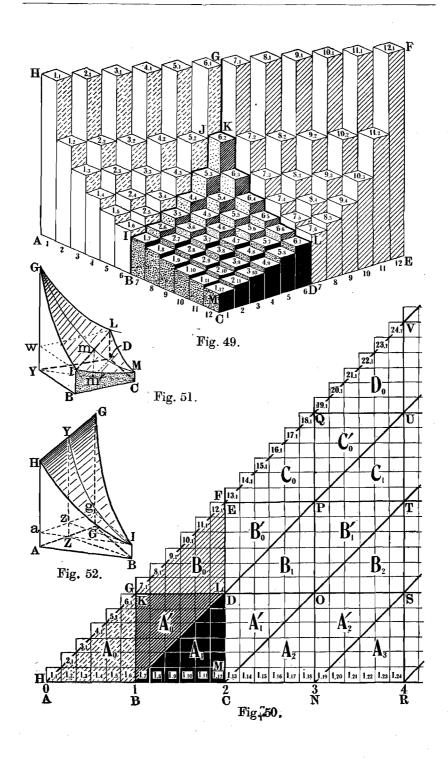
8. Equivalent year of birth in cases of infantile mortality.—In order to avoid circumlocution and to simplify the statement of the problem, we shall assume the period of observation of infantile mortality to be successive calendar years; and the record of births to be also according to calendar years. The necessary variation of this statement for other equal periods is self-evident. From what has been indicated in the preceding section it is clear that the infantile deaths in any year can be referred to a birth-year, which precedes the calendar year by some period less than a half-year. We proceed to evaluate this interval, which obviously depends upon:—(a) the rate at which the cases come under initial observation, that is upon the frequency of birth [or of birth and migration]; and (b) upon the decrease in the rapidity of death in the first year of life. The birth-rate in the ordinary sense is, of course, immaterial. For so limited a period as one year, we can, for the purpose in view, assume that 1 + rt expresses the increase with time of the frequency of births. If we make the origin of the variable, i.e., time, the end of the year of observation, we have to consider the deaths of persons between the age-limits 0 and 1, occurring during the period -1 to 0, drawn obviously from births [and immigration] during the period - 2 to 0, inasmuch as survivors born at the time -2 + t' will be within the agelimits up to the time -1 + t', which also is in the year of observation. Consequently also deaths among these must be taken into account. Thus at the time -t, the ages of persons, the deaths among whom will be included in the category of infantile deaths, will be between 0 and x =1 + t. This connects the time-limits with the age-limits. The range of relative frequency extends from 1 for t = 0, to 1 - 2r for t = -2, (coming under observation, however, only for t = -1, whenever infantile deaths are observed for the same year as births). The question for resolution then is:-

Given the form and constants of the function expressing the variation in the frequency of births, and the form and constants of the function expressing the probability of living to age x, where x is less than 1, what proportion of the infantile deaths in any calendar year is drawn from the year of observation, and what proportion is drawn from the year preceding that of observation. The nature of the problem is illustrated by Figs. 49 to 52, p. 157, which illustrate either the case of deaths, or

that of births and survivors. The deaths occurring in a small unit of time,  $\Delta t$  say, arising from births in the same unit, is represented by the height of the first parallelepiped HA. It embraces all persons of age 0 to age  $0 + \Delta x$ , the period of observation being 0 to  $0 + \Delta t$ , the number being the height HA, and  $\Delta t$  being equal to  $\Delta x$ , these quantities being thus dx and dt when indefinitely small. The number of deaths at the end of a period, say a year, from the survivors of those born at its beginning, is represented by the height BI, and after a second period, say two years, by the height CM, Fig. 49. The succession of deaths are thus represented by the parallelepipeds 1.1, 1.2, 1.3, etc. They are followed by deaths occurring among those born during the period  $\Delta t$  to  $2\Delta t$ , represented by 2.1, 2.2, etc., and so on, these, in an increasing population, being somewhat larger than the former series, since the births from which The parallelepiped F E, or 12.1, they are drawn are greater in number. represents the deaths in the last period, viz.,  $2 - \Delta t$  to 2; 7.1 represents those in the period 1 to  $1 + \Delta t$ , the deaths among the survivors in the successive elementary periods being 7.2, 7.3, etc. Thus, from Figs. 49 and 50, it is at once evident that  $A_{\rho}$ , the deeper shaded figure BIKLDB, represents deaths from survivors from the previous period. The medium shaded figure, B<sub>0</sub>, represents deaths in the period under consideration born in that period, since G to L is contemporaneous with G to F. The broken shaded figure  $A_0$ , or AHGKIBA, represents the deaths occurring in the preceding periods from births in that period; they are similar to B<sub>0</sub>. The black shaded figure, A<sub>1</sub> ,or BILDCB, represents deaths at ages outside the limit, that is, at ages greater than one year (exactly). In short, A<sub>0</sub>, B<sub>0</sub>,.....D<sub>0</sub> represent deaths within the year of record of persons less than one year old;  $A'_0$  to  $C'_0$ , represent deaths of survivors from the preceding year. Similarly in regard to the other figures, A<sub>1</sub> to C<sub>1</sub> represent deaths of persons of age 1 to 2, attaining that age in the year previous to the year of record; while Ai to Bi represent deaths of persons of age 1 to 2 who attain that age during the year of record. Similarly, mutatis mutandis, in regard to A2, B2, and A2, etc.

The figures of the type  $A_0$ ,  $B_0$ ,...,  $A_1$ ,  $B_1$ , etc., are represented by the solid Fig. 52, those of the type  $A_1$ ,  $B_1$ ,...,  $A_2$ ,  $B_2$ , etc., are represented by the solid Fig. 51.

If the origin for x + 0, t + 0, be the point A in Figs. 49, 50, 52 then the lengths of an element of volume in areas  $A_0$ ,  $A'_0$ , and  $B_0$ , taken parallel to A G Q V, Fig. 52, are respectively t - x = 1 - x, x, and 2t - (t + x) = 1 - x.



If the number of births in successive units of time be *constant*, it is obvious that  $A_k = B_k = C_k$ , etc.;  $A'_k = B'_k = C'_k$ , etc.; k being any suffix, and that we have also—

$$(363)...A_0 = B_0 = ... \int_0^1 (1-x) F_3(x) dx$$

$$(364)...A_{0}' = B_{0}' = ... = \int_{0}^{1} x F_{3}(x) dx$$

Consequently the ratio  $B_0/A_\circ'$  is found by dividing the value of (363) by that of (364).

9. Proportion of infantile deaths arising from births in year of record, number of births increasing.—If the number of births be increasing, and the increase be assumed to be at the rate of  $e^{rt} = 1 + rt + \frac{1}{2} r^2 t^2 + \text{etc.}$ ; the quantities will increase, that is, with any common suffix A < B < C. Since the maximum value of r is about 0.03, the effect of the omission of the term  $t^2$ , where it is one year, is of the order of a two-thousandth, and may be ignored. Consequently, the increase in the number of births may, with abundant precision, be taken to vary as 1 + rt. We may take the origin for t as at the point t in Fig. 50, hence an element of the volume of t0, and of t0 will be respectively—

$$(1-x) F_3(x) \delta x (1 + \frac{1}{2} r - rx); \text{ and } x F_3(x) \delta x (1-rx);$$

the element being taken parallel to H G F. The terms in brackets, containing r, represent the mean heights of the volume-elements taken along the lines Y I and G M respectively in Figs. 51 and 52. Hence, multiplying out, the relative values of the volumes representing  $\mathbf{B_0}$  and  $\mathbf{A'_0}$  are respectively as follows:—

(365). 
$$B_0 = \int_0^1 \{(1 + \frac{1}{2}r) F_3(x) - (1 + \frac{3}{2}r) x F_3(x) + r x^2 F_3(x)\} dx$$

(366)..
$$A'_{0} = \dots \int_{0}^{1} \{x F_{3}(x) - r x^{2} F_{3}(x)\} dx$$

From an analysis of the deaths of infants during four years, viz., 1909, 1910, 1912 and 1913, the relative values of the functions to be integrated were found to be as in the following table, viz., XXXVI., in which the figures in the first column represent the number of deaths out of 1,000,000 births, occurring up to the time after birth indicated in the first column, that is up to age  $\boldsymbol{x}$ .

TABLE XXXVI.— Values of above Integrals for Various Periods, Basis 1,000,000 Births, Australia, Years 1909-10; 1911-12.

Period, or Age x.			$\int_0^x F_3(x) dx$	$\int_0^x x F$	$_3$ (x) $dx$ .	$\int_0^x x^2 F_3(x) dx.$			
		***		_	Number.	Number.	Proportion.	Number.	Proportion
1	day	·		٠.	9,360	11	.0012	0	.0000
2	,,				14,032	27	.0019	0	.0000
4	,,				17,257	57	.0033	0	.0000
5	,,	٠.			18,500	73	.0039	1	.0001
10	,,				22,573	154	.0068	2 <b>5</b>	.0001
15	,,				25,335	247	.0097	5	.0002
20	,,				27,497	350	.0127	10	.0004
25	,,				29,228	457	.0156	` 17	.0006
30	,,				30,645	563	.0184	25	.0008
30.437	,,	or 1	mth		39,757	$\bf 564$	.0184	26	.0008
60.874	,,	2	,,	l	37,231	1,362	.0366	128	.0034
91.311	,,	3	,,		42,796	2,517	.0588	370	.0086
121.747	,,	4	,,		47,735	3,953	.0828	¹ <b>790</b>	.0165
52.181	,,	5	,,		52,165	5,612	.1076	1,413	.0271
182.621	,,	6	,,		56,128	7,424	.1323	2,246	.0400
213.058	• •	7	,,		59,688	9,349	.1566	3,289	.0551
243.495	,,	8	,,		62,920	11,367	.1807	4,551	.0723
273.932	,,	9	,,		[65,871	13,455	.2043	6,030	.0915
304.368	,,	10	,,		68,563	15,585	.2273	7,716	.1125
334.805	,,	11	,,		71,045	17,755	.2499	9,615	.1353
865.242	,,	12	,,		73,366	19,973	.2722	11,736	.1600

<sup>\*</sup> Proportion of number in second column.

From these results, the values given in the next table, viz., XXXVII., have been computed, agreeably to formulæ (365) and (366). The results shew that with quarterly records, over 94 per cent. of the recorded deaths are referable to births in that quarter; with half-yearly about 87 per cent., and with yearly records about 73 per cent., provided the intervals between occurrence and record are the same in both cases.

TABLE XXXVII.—Proportion of Deaths under One Year of Age, born during the Year in which the Death is Recorded. Australia, 1909, 1910, 1912, 1913.

				R	ate of Inc	rease of B	rths.	
Interval of Time Considered.				1.00 (constant).	1.01	1.02	1.03	1.04
15	days			.9903	.9903	.9904	.9905	.9906
1	month			.9816	.9817	.9818	.9820	.982
2	,,			.9634	.9636	.9639	.9641	.9644
3	,,			.9412	.9415	.9418	.9422	.9428
4	,,			.9172	.9176	.9181	.9185	.9190
5	,,			.8924	.8930	.8936	.8942	.894
6	,,		٠.	-8677	.8685	.8693	.8701	.870
7	,,		٠.	.8434	.8444	.8454	.8465	.847
8	,,			.8193	.8204	.8216	.8227	.8239
9	,,		٠.	.7957	7970	.7983	.7996	.8009
10	,,			.7727	.7742	.7756	.7771	.778
11	,,		٠.	.7501	7517	.7534	.7550	.756'
12	**			.7278	.7296	.7314	.7332	.735

It will be seen from the above table that, for any ordinary increase of birth-rate the effect thereof upon the proportions given may be ignored for ordinary purposes; that is, with the infantile-death rates experienced in Australia, it may be assumed that 0.73 of the deaths recorded in any year occur in that year, whatever the increase of the birth-rate, and this will be approximately true generally.

10. Secular fluctuation in birth-rates.—The birth-rates since 1860 for Australia are as shewn in the following table:—

TABLE XXXVIII.—Crude Birth-rates, and Marriage-rates, Australia, 1860 to 1914.

Ye				Re	tes p	er 100,	000 c	of the I	opul	ation.			
of Deca		1860		1870	<b>).</b>	1880		1890		1900	.	1916	).
0		B 4,256	M 842	B 3,866	M 712	B 3,525	M 717	B 3,498	M 764	B 2,733	M 724	B 2,673	M 837
ĭ		4,228	864	3,800	694	3,526	760	3,447	747	2,733 $2,716$	732	2,073 $2,721$	879
		4,327*		3,707	696	3,448	810	3,365	674	2,671	726	2,865	907
2 3		4,166	837	3,744	740	3,482	836	3,279	619	2,529†		2,825	866
4	• •	4,291	861	3 <b>,6</b> 79	720	3,560	828	3,083	608	2,641	702	2,805	880
5		4,210	834	3,588	728	3,569	816	3,038	623	2,623	725		
6		3,979	762	3,592	714	3,537	788	2,843	655	2,657	749		
7		4,042	751	3,499	731	3,560	759	2,821	668	2,676	787		
8 9	• •	4,046	755	3,539	737	3,550	798	2,715	672	2,659	776		
9		3,865	733	3,577	716	3,465	767	2,727	703	2,669	790		1.

<sup>\*</sup> The highest value was in 1862.

These rates shew a fairly steady decrease till 1903, and then an inconspicuous rise. Their significance will be dealt with later, viz., in the part treating of "fecundity."

Secular as well as any other fluctuations in the birth-rate are of course influenced by the marriage-rate. This rate is also shewn in the above table. The figures in the columns denoted by B are birth-rates, and in those denoted by M are marriage-rates. Fig. 53 shews both results by dots, the general trends—ignoring small oscillations—being indicated by the broken lines among the dots. The scale of values for the marriage curve is ten times as much enlarged as that for the birth-rate curve: see p. 165.

The long-continued fall in the birth-rate, which has been characteristic of Australia, is characteristic also of the countries of the western world. The rates for as many years as are available for various countries are as shewn in the table hereunder. These are also graphed in Fig. 53. They afford unmistakable evidence of what may be called the Malthusian

<sup>†</sup> The lowest value was in 1903.

drift of the world during the last 50 years, which drift, however, is on the whole contemporaneous with a conspicuous reduction of infantile mortality, so that the "residual birth-rates" would shew a much less marked effect. It is after all the residual rate which is of greater importance.

TABLE XXXIX.

Crude Birth-rates for Various Countries—1860-1914—per 10,000 of the Population.

Year.	Australia.	England and Wales.	Scotland.	Ireland.	France.	Prussia.	Italy	Switzerland.	Norway.	Sweden.	Denmark.	Netherlands.	Belgium.	Austria.	Hungary.	Mean.
1860 1861 1862 1863 1864	426 423 433 417 429	348 346 350 353 354	356 349 346 350 356	:: :: 240	262 269 265 269 266	386 377 372 395 397	  379	::		348 326 334 336 336	318 310 311 303	319 354 332 364 357	306 308 301 318 315	379 372 379 403 403	::	881 844 242 352 345
1865 1866 1867 1868 1869	421 398 404 405 387	354 352 354 358 348	354 354 351 353 343	257 262 260 268 267	265 264 264 257 257	393 393 371 369 379	385 390 367 354 372		::	328 331 308 275 282	314 322 305 312 295	361 354 354 349 343	314 327 321 325 316	378 379 366 379 393	421 388 424 426	344 350 340 341 339
1870 1871 1872 1873 1874	387 380 371 374 368	352 350 356 354 360	346 345 349 348 356	277 281 278 271 266	255 229 267 260 262	383 338 397 396 401	369 370 379 363 349	298 291 300 299 305	292 297 299 307	288 304 300 308 309	305 302 303 308 309	361 354 360 362 364	323 310 323 325 326	396 389 391 399 397	417 430 410 422 427	339 331 339 339 334
1875 1876 1877 1878 1879	359 360 350 354 358	354 363 360 356 347	352 356 353 349 343	261 264 262 251 252	259 262 255 252 251	407 407 399 387 390	377 392 370 362 378	320 330 323 316 308	312 318 318 311 320	312 308 311 298 305	319 326 324 317 320	366 371 366 361 367	325 332 323 315 315	399 400 387 386 392	450 463 436 431 458	345 350 343 337 340
1880 1881 1882 1883 1884	352 353 345 348 356	342 339 338 335 336	336 337 335 328 337	247 245 240 285 239	246 249 248 248 247	378 370 367 371 376	339 380 371 372 390	298 300 291 288 285	307 300 309 309 310	294 291 294 289 300	318 323 324 318 334	355 350 353 343 349	311 314 312 305 305	380 377 391 382 387	428 429 438 448 456	323 351 331 328 334
1885 1886 1887 1888 1889	357 354 356 355 346	329 328 319 312 311	327 329 317 313 309	235 232 231 228 227	243 239 235 231 230	377 377 377 374 371	386 370 389 375 383	280 280 280 278 276	313 309 308 308 297	294 298 297 288 277	326 326 320 317 313	344 346 337 337 332	299 296 294 291 295	376 380 382 379 379	448 456 442 438 437	328 328 326 322 <b>3</b> 13
1890 1891 1892 1893	350 345 337 328 308	302 314 304 307 296	304 312 307 308 299	223 231 225 230 230	218 226 223 228 228	366 377 363 375 366	358 372 362 365 355	264 278 274 277 273	303 309 296 307 298	280 283 270 274 271	306 309 295 305 <b>3</b> 01	329 337 320 338 327	287 296 289 295 290	367 370 362 379 367	403 423 404 426 415	311 319 309 316 307
1895 1896 1897 1898 1899	304 284 282 271 273	303 296 296 293 291	300 304 300 301 298	233 237 235 233 231	217 225 222 218 219	369 369 365 367 363	349 348 347 335 339	273 281 283 285 290	306 304 300 303 309	275 272 267 271 264	300 305 298 302 297	328 327 325 319 321	285 290 290 286 288	381 380 375 363 373	418 405 403 377 393	310 309 306 302 303
1900 1901 1902 1903 1904	273 272 267 253 264	287 285 285 285 280	296 295 293 294 291	227 227 230 231 236	214 220 217 211 209	361 362 355 344 347	330 326 334 317 329	286 290 285 274 273	301 296 289 288 281	270 270 265 257 258	297 297 292 287 289	316 323 318 316 314	289 294 284 275 271	373 366 371 353 356	393 378 389 369 374	301 300 298 290 290
1905 1906 1907 1908 1909	262 266 268 266 267	273 272 265 <b>26</b> 7 <b>2</b> 58	286 286 277 281 273	234 235 232 233 234	206 206 197 201 195	335 337 330 227 317	327 321 317 337 327	269 269 262 264 255	274 267 264 263 263	257 257 255 257 256	284 285 282 285 285 282	308 304 300 297 291	261 257 253 249 237	339 350 340 337 334	363 365 367 369 377	285 285 281 282 278
1910 1911 1912 1913	268 272 286 282	251 244 238 239	262 256 259 255	233 232 230 228	196 187 190 190	305 294 289	333 315 324	250 242 241	261 259 256 252	247 240 237 231	275 267 267 256	286 278 281 281	237 229 226	325 314 313	357 350 363	273 265 247 246
Mean	354	335	338	243	235	366	357	284	296	287	304	335	296	374	411	

This curve of birth-rate averages, convex upwards, discloses a continuous and accelerating decrease with time, *i.e.*, the Malthusian gradient shews an accelerating increase. This fact is significant, and is worthy of special notice. If the tendency to reduction of the birth-rate were one which bore a constant ratio to the rate itself we should have—

$$(367)....d\beta/dt = -\kappa\beta$$
; or  $d\beta/\beta = -\kappa dt$ ;

 $\beta$  denoting the birth-rate, and  $\kappa$  a constant. In this case we should have by integrating—

(368).....log. 
$$\beta = -\kappa t + c$$
; or  $\beta = Ce^{-\kappa t}$ 

in which log. C=c, or  $C=e^{c}$ , a curve which of course is concave upwards, not convex. Again, a linear diminution of the birth-rate, viz., one of the form—

$$(369)\ldots\beta=\beta_0(1-kt)$$

is an accelerating reduction of the relative increase of the population by births, consequently the convexity upwards of the curve implies a still more rapid reduction than a linear one.

11. The Malthusian law.—The question naturally arises whether the birth-rate phenomena may properly be considered as conformable to the law enunciated by Malthus, which may be stated thus:—If, as time goes on, food-production increases in an arithmetical, while population increases in a geometrical, ratio, the latter must inevitably overtake and surpass the former.

Let us suppose that from any given moment (i.e., for t=0) the (possible) increase of food-production is continually in the ratio 1+qt, and that the population increase is continually  $e^{rt}$ . Both expressions are unity for t=0. Let q=Mr. The factor M, we may suppose to be considerably greater than unity. Thus for small values of t, the value of 1+qt is greater than  $e^{rt}$ . To determine the value for t, when the two expressions become equal, we put—

$$(370)\dots 1 + qt = 1 + Mrt = e^{rt}.$$

By expanding, subtracting unity from each side of the equation, transposing and dividing by  $\frac{1}{2}r$ , we get for Y, the number of years when the population will overtake the food supply.

(371).. 
$$Y = \frac{2(M-1)}{r} = t \left(1 + \frac{1}{3}rt + \frac{1}{3.4}r^2t^2 + \frac{1}{3.4.5}r^3t^3 + \text{etc.}\right)$$

The ratio r being very small, this equation may be solved for t by successive approximations, for which purpose the equation is preferably written in the form—

$$(371a)....Y = \frac{2(M-1)}{r} = t\left\{1 + \frac{1}{3}rt\left[1 + \frac{1}{4} t(1 + \frac{1}{5}rt + ...)\right]\right\}^{1}$$

The values of r range up to about 0.03. The solution of this leads to a remarkable result, viz., that if the food-supply can be increased in the ratios 1, 1 + Mr, 1 + 2 Mr + ... 1 + tMr, as the years pass, then after a relatively small number of years there will be a shortage, though in the interim there will be an excess. The interval of time necessary, with population increasing continually at any given rate, and the food-production increasing by uniform amounts per annum, may be called the "Malthusian equivalent interval."

12. Malthusian equivalent interval.—These intervals have been computed, here, for the cases where the annual increase of food supply is either 2, 4, 8, or 16 times that at which the population is continually increasing.

TABLE XL.—Malthusian Equivalent Intervals corresponding to various Rates of Increase.

Number Food Su ceeds N Popul	pply E	x- f	Number of Years (t) Betore Population Overtakes Food-Supply, the former increasing as $e^{rt}$ , the latter as $(1 + Mrt)$ .								
	М.		rt.	r=0.01	r = 0.015.	r = 0.02	r=0.03				
2			1.2564	125.6	83.8	62.8	41.9				
4		••	2.3370	233.7	155.8	116.8	77.9				
8			3.3150	331.5	221.0	165.7	110.5				
16	• •		4.2290	422.9	281.9	211.4	141.0				

<sup>\*</sup> Initially.

The above table shews that even if the possibility of increasing the food supply was initially larger, the interval of time elapsing before the increase of population would overtake that of food supply is small compared with historical or geological periods. Thus it will be seen that the conclusions of II., § 34, pp. 30-32 hereinbefore, are supported from a somewhat different point of view; in other words, the general truth of Malthus' proposition is certain. In short, the ordinary rates of population increase, small as they may appear to some investigators, are sufficient

If a table of values of  $e^x$  be available, we may rewrite (371) in the form  $\mathbf{M}x = e^x - 1$ , consequently  $\mathbf{M} = (e^x - 1) / x$  and this can be solved by trial. The following values will serve for most cases required.

x = .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 2. 3 4. 5. M = 1.052 1.107 1.166 1.255 1.297 1.370 1.448 1.532 1.622 1.718 3.195 6.362 13.400 29.483

to bring about, in a relatively short time, trouble from over population, at least in countries where the population density is already appreciable. In this connection it may be of interest to mention that the rates for Australia deduced from the populations determined as at the censuses of 1901, 1911, and from the deaths for that intercensal period, shew that for the number of males and females at birth to be each constantly 100,000 per annum the constant populations would have to be as follows—

	FOR MALES.	FOR FEMALES.
Population $(T_0)$ .	. 5,520,030;	5,883,742;
Number born $(l_0)$ .	. 100,000;	100,000;
Expectation of life (e <sub>o</sub> )	55,200;	58,837;
Death-rate $\frac{l_0}{T_0} = \frac{1}{e_o^\circ}$	= 0.01812;	0.01700

Thus if the death-rates and birth-rates were equal, a constant population of 5,701,886, with a crude masculinity of 0.938184, would give 100,000 births, in which the numbers of the sexes would be initially equal. The masculinity of the actual population based on the aggregates for the years 1901 to 1910 inclusive was actually 1,115600. The ascertained increases of population due to excess of births over deaths and of immigrants over emigrants were, however, as follows:—

Population at 31st December, 1900-

Males 1,976,992; Females 1,788,347; Total 3,765,339 Population at 31st December, 1910—

Males 2,296,308; Females 2,128,775; Total 4,425,083

Decennial Increase of Population-

Males, 319,316; Females, 340,428; Total, 659,744.

Rate of continuous increase—

$$r_{\rm m} = 0.0149726$$
;  $r_{\rm f} = 0.017426$ ;  $r_{\rm p} = 0.0161435$ .

As already shewn this rate of increase could not, of course, possibly be maintained over many centuries.

13. The Malthusian coefficient and Malthusian gradient.—Let us suppose that in any community unrestricted fecundity would give a birth-rate B, the actual birth-rate, however, being  $\beta = mB$ . The value of m is necessarily less than unity, and is a coefficient of reduction which diminishes in the ratio that the birth-rate diminishes. This coefficient may be called the *Malthusian Coefficient*, since it measures the degree of the restriction of fecundity which characterises the community in question. Thus—

$$(372)\dots m = \beta/B.$$

<sup>&</sup>lt;sup>1</sup> See the Essay on the Principle of Population; or a view of its past and present effects on human happiness; etc., by T. R. Malthus, A.M.; Professor of History and Political Economy, East India College. In particular Chap. IX. pp. 506-536, 4º Edit., 1807.

## BIRTH-RATES OF VARIOUS COUNTRIES, 1860 to 1913.

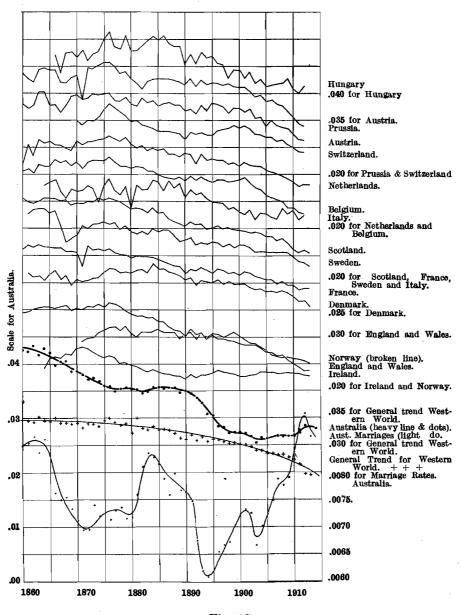


Fig. 53.

The heavy curve with heavy dots is the general trend of the Australian birth-rates, the dots denoting the individual annual rates. The light curve with light dots is the general trend of the Australian marriage-rates in Australia, the dots denoting the individual annual rates. The light curve with vertical crosses +++ is the unweighted average of the various birth-rate curves, the crosses denoting the mean of the annual values.

If  $\beta = f(t)$ , we shall have also  $B_{IR} = f(t)$ , that is the graphs of the two are of the same form and differ only in scale. The question of the determination of this coefficient will be later considered.

The general change in the values either of the birth-rate or of the Malthusian coefficient, if regarded as characteristic of any country, is best found by taking the means *irrespective of the magnitude of the populations*. A mean so found does not, of course, apply to the aggregate of the populations; a weighted mean would do so however.

The Malthusian gradient (a) may be defined either as the rate of fall of the curve representing the birth-rate, or as the rate of fall of the curve representing the Malthusian coefficient. Until B is determined, see above, the former definition is the more practical. Thus—

(373).... 
$$g = \frac{d\beta}{dt} = \frac{df(t)}{dt}$$
; or  $= \frac{d\beta}{Bdt} = \frac{df(t)}{Bdt}$ 

of which the former is, at present, to be preferred.

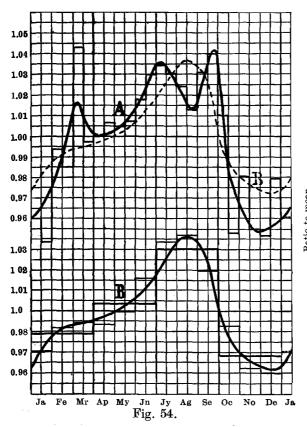
- 14. Reaction of the marriage-rate upon the birth-rate.—If the marriage-rates were constant in all communities, or were constant at different periods in the one community, the birth-rates would be properly comparable as measures of fecundity. The effect of the marriage-rates depends, however, upon the degree of fecundity characteristic of different ages of life; hence exact comparisons of the fecundity are possible only after a correction is applied depending upon its variation with age and the age distribution of the marriages. This question will be considered hereinafter. It will suffice to observe that there is some slight indication of the correlation of the facts exhibited by the curves representing the birth and marriage rates, Fig. 53, though the effect is easily masked by the economic factors which influence human affairs: see p. 165.
- 15. Annual periodic fluctuation of births.—In order to see whether there was any distinct evidence of a seasonal fluctuation among births, the numbers of births have been compiled, according to the actual date of birth, for the three years 1911-1913, in equalised half-months, and, assuming the rate of increase of population to be uniform, these numbers were corrected for its general increase during the period. The results are as follow:—

TABLE XLI.—Seasonal Fluctuations in the Corrected Frequency of Births.

Australia, 1911-1913.

			Au	stralia	, 1911·	-1913.					_
January.		February.		March.		April.		Мау.		June.	
14,444	14,350	15,045	14,893	15,766	15,058	15,098	15,218	15,132	15,202	15,347	15,445
893	806	831	835	896	870	872	857	912	887	905	1,003
1		'	1	′		<i>'</i>	'	'		, i	-
Jul	ly.	Aug	rust.	Septe	mber.	Octo	ber.	Nove	mber.	Dece	mber.
15,542	15,513	15,367	15,216	15,514	15,715	15,183	14,323	14,787	14,398	14,352	14,775
975	949	986	961	946	903	955	902	872	849	846	867
- '	· 1	, i	•		1	,	-				•
	14,444 893 15,337 .9604 Jul 15,542 975 16,517	14,444 14,350 806 15,337 15,156 .9604 .9491  July. 15,542 15,513 949 16,517 16,462	14,444 14,350 15,045 893 806 831 15,337 15,156 15,876 .9604 .9491 .9942  July. Aug 15,542 15,513 15,367 975 949 986 16,517 16,462 16,553	January.         February.           14,444         14,350         15,045         14,893           893         806         831         835           15,337         15,156         15,876         15,728           .9604         .9491         .9942         .9849           July.         August.           15,542         15,513         15,367         15,216           975         949         986         961           16,517         16,462         16,353         16,177	January.         February.         Ma           14,444         14,350         15,045         14,893         15,766           893         806         831         835         896           15,337         15,156         15,876         15,728         16,662           .9604         .9491         .9942         .9849         1.0434           July.         August.         Septe           15,542         15,513         15,367         15,216         15,514           975         949         986         961         946           16,517         16,462         16,353         16,177         16,460	January.         February.         March.           14,444         14,350         15,045         14,893         15,766         15,058           893         806         831         835         896         870           15,337         15,156         15,876         15,728         16,662         15,928           .9604         .9491         .9942         .9849         1.0434         .9974           July.         August.         September.           15,542         15,513         15,367         15,216         15,514         15,715           975         949         986         961         946         903           16,517         16,462         16,353         16,177         16,460         16,618	14,444	January.         February.         March.         April.           14,444         14,350         15,045         14,893         15,766         15,058         15,098         15,218           893         806         831         835         896         870         872         857           15,337         15,156         15,876         15,728         16,662         15,928         15,970         16,075           .9604         .9491         .9942         .9849         1.0434         .9974         1.0001         1.0066           July.         August.         September.         October.           15,542         16,513         15,367         15,216         15,514         15,715         15,183         14,323           975         949         986         961         946         903         955         902           16,517         16,462         16,353         16,177         16,460         16,618         16,138         15,225	January.         February.         March.         April.         March.           14,444         14,350         15,045         14,893         15,766         15,058         15,098         15,218         15,132           893         806         831         835         896         870         872         857         912           15,337         15,156         15,876         15,728         16,662         15,928         15,970         16,075         16,044           .9604         .9491         .9942         .9849         1.0434         .9974         1.0001         1.0066         1.0047           July.         August.         September.         October.         Nove           15,542         15,513         15,367         15,216         15,514         15,715         15,183         14,323         14,787           975         949         986         961         946         903         955         902         872           16,517         16,462         16,353         16,177         16,460         16,618         16,138         15,225         15,659	January.         February.         March.         April.         May.           14,444         14,350         15,045         14,893         15,766         15,058         15,098         15,218         15,132         15,202           893         806         831         835         896         870         872         857         912         887           15,337         15,156         15,876         15,728         16,662         15,928         15,970         16,075         16,044         16,089           .9604         .9491         .9942         .9849         1.0434         .9974         1.0001         1.0066         1.0047         1.0075           July.         August.         September.         October.         November.           15,542         15,513         15,367         15,216         15,514         15,715         15,183         14,323         14,787         14,398           975         949         986         961         946         903         955         902         872           16,517         16,462         16,953         16,177         16,460         16,618         16,188         15,225         15,659         15,247	January.         February.         March.         April.         May.         Ju           14,444         14,350         15,045         14,893         15,766         15,058         15,098         15,218         15,132         15,202         15,347           893         806         831         835         896         870         872         857         912         887         905           15,337         15,156         15,786         15,728         16,662         15,928         15,970         16,075         16,044         16,089         16,252           .9604         .9491         .9942         .9849         1.0434         .9974         1.0001         1.0066         1.0047         1.0075         1.0177           July.         August.         September.         October.         November.         Decentary           15,542         15,513         15,367         15,216         15,514         15,715         15,183         14,323         14,787         14,398         14,352           975         949         986         961         946         903         955         902         872         849         846           16,517         16,462 <td< td=""></td<>

The semi-monthly means for nuptial, ex-nuptial and total births were 15,070,899, and 15,969 respectively. An examination of the results



shews that a fluctuation certainly exists, and although the number of ex-nuptial births is both relatively and absolutely very small, the agreement of the fluctuation of nuptial with that of ex-nuptial births is fairly definite. The results for the totals are shewn by curve A, Fig. 54, the curved line denoting the general trend of the fluctuation.

In order to further examine the question, the quarterly results of the births, as registered, during the eight years 1907-1914 were compiled, and this is done also for population. The interval between

birth and registration has, however, shortened since the introduction of a maternity bonus: see pp. 151 and 152.

The following procedure was adopted. The births registered were taken out in the several quarters; these quarters were then equalised, the numbers being corrected to shew what would have been given by a constant population, since it was found that the increase of this last was sensibly at the rate  $1 + 0.0247265 \ t$ . In this way the values shewn in Table XLII. hereinafter were obtained. These quarterly results may be subdivided into monthly values, as explained on the next section, so as to give the monthly values. These results are shewn by the curve B in Fig. 54.

TABLE XLII.—Births Registered. Australia, 1907-1914.

Bi	rths as R	egistered.				l for Equal ant Popula	
236,462	243,191	254,141	242,860	241,457	244,914	251,457	238,830
_		_	_	.98891	1.00307	1.02987	.97815

The values for the individual months may be deduced as explained in the next section, and are as follows:—

1 2 3 4 5 6 7 8 9 10 11 12 .9807 .9916 .9944 .9936 .9996 1.0160 1.0333 1.0366 1.0197 .9924 .9922 .9699 and these monthly results are shewn by the small rectangles in curve B, Fig. 54.

For the greater part of the year, at least, the results are substantially identical for the two sexes, as a compilation made for the four years, 1907-1910, shews. The results were as follows:—

TABLE XLIII.—Seasonal Fluctuations\* of Births, according to Sex.

Australia, 1907-1910.

Males, Females or Persons.	Jan.	Feb.	Mar.	April	May.	June.
M	.9874	.9169	.9949	1.0152	1.0064	.9978
F	.9903	.9229	.9950	1.0079	1.0069	.9859
P	.9889	.9198	.9949	1.0116	1.0067	.9920
-	July.	Aug.	Sept.	Oet.	Nov.	Dec.
M	1.0321	1.0410	1.0299	1.0378	.9924	.9482
F	1.0170	1.0583	1.0437	1.0465	.9760	.9479
P	1.0249	1.0504	1.0367	1.0420	.9844	.94 <b>8</b> 0

<sup>\*</sup> The registration was on the average 38.2 days after birth for the years 1907-1910.

Reverting to curves A and B, Fig. 54, the curve drawn by lines may be taken as a probable representation of the fluctuation; since there is no reason to suppose that the large oscillations are other than accidental.

As the theory of determining the Fourier curves to fit the group results presents certain special features, it is given hereunder.

16. The subdivision of results for equalised quarters into values corresponding to equalised months.—When quarterly results are available, they may (after equalising and also being freed from the annual progression so as to give, as residuals, only the fluctuation elements) be readily resolved into monthly values, which have a high degree of probability. The most convenient form in which to give such results is the height of the monthly group. Let the mean of the heights of four quarterly groups be denoted by R, with suffixes corresponding to the quarter (viz., 1 to 4), and that of the monthly group by r, with corresponding suffixes (viz., 1 to 12). Then the solution can proceed on one of two possible assumptions, viz. (a) that the amplitudes of the component fluctuations are identical, and the epochs are different, or (b) that the epochs are identical and the amplitudes are different.

That is, we may assume either (a) that—

$$(375)...y = a + b \sin((x + \beta)) + b \sin(2(x + \gamma));$$

or (b), that—

$$(376)...y = a + b \sin((x + \beta)) + c \sin(2(x + \beta)).$$

The data are, of course, inadequate in themselves to determine which assumption should be adopted, and the results are to that extent, uncertain. But this uncertainty, in general, is of small moment.

In case (a) we have—

$$(377)...l = -\frac{6}{\pi}b\cos.\beta = \frac{3}{2}(R_3 + R_4); m = \frac{6}{\pi}b\sin.\beta = \frac{3}{2}(R_1 + R_4).$$

$$(378)..p = -\frac{3}{\pi}b\cos 2\gamma = \frac{3}{4}(R_2 + R_4); q = \frac{3}{\pi}b\sin 2\gamma = \frac{3}{4}\sqrt{-2(R_1R_3 + R_2R_4)}$$

It will be seen that q is not independent of l, m and p, since we must have—

$$(379).....q^2 = \frac{1}{4} (l^2 + m^2 - 4 p^2)$$

From this last, the value  $\frac{3}{4}\sqrt{-2}$   $(R_2R_4+R_1R_3)$  is deduced. Observing that  $\frac{1}{2}\sqrt{3}-1=-0.1339746$ ;  $\frac{1}{2}(1-\sqrt{3})=-0.3660254$ ; we may put the values of  $r_1$  to  $r_{12}$  in the following very convenient forms, viz.:—

$$(380).....r_1 = -0.1340 l + \frac{1}{2} m - \frac{1}{2} P + 0.8660 q.$$

$$(381)....r_2 = -0.3660 l + 0.3660 m - P$$

<sup>&</sup>lt;sup>1</sup> See Studies in Statistical Representation (Statistical Applications of the Fourier Series), by G. H. Knibbs, Journ. Roy. Soc. New South Wales, Vol. xlv., pp. 76-110, 1911. In particular see pp. 88-89.

$$(382).....r_{3} = -\frac{1}{2}l + 0.1340 m - \frac{1}{2}P - 0.8660 q.$$

$$(383).....r_{4} = -\frac{1}{2}l - 0.1340 m + \frac{1}{2}P - 0.8660 q.$$

$$(384).....r_{5} = -0.3660 l - 0.3660 m + P$$

$$(385).....r_{6} = 1.8660 l - \frac{1}{2}m - \frac{1}{2}P + 0.8660 q.$$

$$(386).....r_{7} = +0.1340 l - \frac{1}{2}m - \frac{1}{2}P + 0.8660 q.$$

$$(387).....r_{8} = +0.3660 l - 0.3660 m - P$$

$$(388).....r_{9} = +\frac{1}{2}l - 0.1340 m - \frac{1}{2}P - 0.8660 q.$$

$$(389).....r_{10} = +\frac{1}{2}l + 0.1340 m + \frac{1}{2}P - 0.8660 q.$$

$$(390).....r_{11} = +0.3660 l + 0.3660 m + P$$

$$(391).....r_{12} = -1.8660 l + \frac{1}{2}m - \frac{1}{2}P + 0.8660 q.$$

In case (b) we have—

$$(392)....l = -\frac{6}{\pi} \ 8 \ b \cos = \frac{3}{2} (R_3 + R_4); \ m = \frac{6}{\pi} \ b \sin \beta = \frac{3}{2} (R_1 + R_4).$$

$$(393).... P = -\frac{3}{\pi} c \cos 2\beta = \frac{3}{4} (R_2 + R_4); \ q = \frac{3}{4} \sqrt{\frac{c^2}{b^2} [(R_3 + R_4)^2 + (R_1 + R_4)^2] - (R_1 + R_3)^2}$$

Again, q is not independent of l, m, and p, since we have—

$$(394)...... \frac{4b^2}{c^2} = \frac{l^2 + m^2}{p^2 + q^2}; \text{ or } q^2 = \frac{c^2}{4b^2} (l^2 + m^2) - P^2.$$

which leads to the value of q above written.

If c = b, the last expression for q in (394), reduces to that first given, viz., in (379). It is obvious from this last value for q, that the ratio c/b is at our disposal, and provided it be so chosen that the whole expression within the braces is not negative, there will be a real value for q. A unique solution will be that which makes the q term zero in the above series of equations for monthly values. This is given by making the expression within the braces in (393) zero. Hence for this we have

$$(395).....\frac{c}{b} = (R_1 + R_3) / \sqrt{\{(R_3 + R_4)^2 + (R_1 + R_4)^2\}}$$

If, therefore, the relation between  $\beta$  and  $\gamma$ , and between b and c are both unknown, we may, with advantage, write q=0 in the series of equations 380) to (391). In short, if we assume that c=b then  $\gamma$  is determinate.

If this relation be not assumed, but that  $\gamma=\beta$  is assumed, we may, within certain limits, still make the ratio of c to b whatsoever we choose, and, if we have no ground for believing that a particular ratio is to be preferred, the simplest solution of the whole problem is, making the epochal angles  $\beta$  and  $\gamma$  identical, to so take the ratio of c to b that the q term will be eliminated from the series of equations for monthly values, viz., formulæ (380) to (391), etc.; that is, we may determine this ratio by (395)<sup>1</sup>. It may be reiterated that the subdivision of the quarterly into monthly values by the preceding formulæ assumes that the fluctuation involves only terms sin. x and sin. 2x.

17. Equalisation of periods of irregular length.—In order to apply the formulæ of the preceding section, it has already been indicated that the crude data must be freed from any annual progression depending on a progression in population numbers and among the births themselves. It is preferable to operate, therefore, on rates, i.e., to divide the number of births (or marriages or deaths, etc.) each month, quarter, or year, as the case may be, by the mean population of the month, quarter, or year itself. Even then a correction is necessary, since for precise results it is still necessary to equalise the period, in fact, if the seasonal fluctuation (or annual period of oscillation) to be determined be small in amplitude, the equalisation is an essential. Both months and quarters differ appreciably in length.<sup>2</sup>

For population-numbers and for birth-numbers, the equalising corrections will necessarily be made in a somewhat different manner. A table of corrections for the ends of the months or quarters is first formed. Numbers such as population-numbers and rate-numbers may be called continuant, and those such as numbers of birth, marriages and deaths, etc., accretional. For the purpose of corrections it may also be assumed that the daily values at the terminals of the unequal periods is the mean of the values for the adjoining periods.<sup>3</sup>

Then, except for the first and final period, there are two corrections. For a single leap-year there is no correction at the end of August, and none at the end of October. The equalised February is always in January, and excepting as above mentioned the terminal of the equalised month is always in the month following.<sup>4</sup>

<sup>&</sup>lt;sup>1</sup> Such a solution has the further advantage of making the deviations from the averages for the respective quarters a minimum.

 $<sup>^2</sup>$  The shortest month is no less than 8 per cent. short of the average, and shortest quarter 1.37 per cent.

<sup>&</sup>lt;sup>3</sup> It is more rigorous, of course, to determine the function, the integral of which gives the result dealt with, but this process is tedious and ordinarily quite unnecessary.

<sup>&</sup>lt;sup>4</sup> There would have been some advantage if January had had 30 days, instead of 31, and February 30 days in ordinary and 31 in leap years, instead of 28 and 29 days.

Let  $\delta T$  and  $\delta' T$  be the small periods to be added respectively to the beginning and the end of an unequal period to make it coincide with an equalised period, the length of this last being  $T_0$ . Let also the periods preceding and following that to be corrected be denoted by T and T'; and let the period to be corrected be denoted by  $T_m$ . Then, the correcting periods  $\delta T$ , etc., being small, we have very approximately, for continuant numbers, P,  $P_m$  and P', etc., denoting that corresponding to  $T_0$ .

$$(397)...P_0 = P_m + \frac{1}{2T_0} \{ (P - P_m) \delta T + (P' - P_m) \delta' T \}$$

and for accretional numbers, N,  $N_m$ , N', etc.,  $N_0$  denoting that corresponding to the period  $T_0$ ,

$$(398)...N_{0} = N_{m} - \frac{1}{2} \left\{ \left( \frac{N}{T} + \frac{N_{m}}{T_{m}} \right) \delta T + \frac{1}{2} \left( \frac{N_{m}}{T_{m}} + \frac{N'}{T'} \right) \delta' T \right\}$$

$$= N_{m} + \frac{1}{2T_{0}} \left\{ -(N + N_{m}) \delta T + (N_{m} + N') \delta' T \right\}$$

The approximate identity of these expressions can readily be established.¹ In regard to the sign of the corrections it may be observed that for continuant numbers the value is to be *increased* when the shift of *either* terminal of the unequalised period towards the terminal of the equalised period is in the direction of higher values. For accretional numbers, the number is increased for an additive shift, diminished for a negative shift.

18. Determination of a purely physiological annual fluctuation of birth-rate.—The annual birth-rate fluctuation, as obtained in section 15, by means of the formulae of sections 16 and 17, cannot be regarded as furnishing the variations of the reproductive activity solely due to physiological causes, which variations may be presumed to repeat themselves every year. The distribution of the frequency of marriage, and therefore of birth, throughout the year is affected by the fêtes observed, and particularly by the "movable feasts" (Easter, etc.). The number of years to be included to secure a true mean-determination must embrace the whole cycle of movement. The extent of this cycle has been referred to in a paper on the Statistical Application of the Fourier Series, by the writer.<sup>2</sup> But even when this mean result is obtained, what may be called the physiological fluctuation is not to hand, since the effect of the "movable feast" is distributed, not eliminated. By a systematic analysis,

<sup>&</sup>lt;sup>1</sup> The question of corrections of this kind has been dealt with at length by me in a paper read 5th July, 1911, at the Roy. Soc., N.S.W., see its Journ. xlv., pp. 79-85, which treats of the correction of an increasing population, and that for unequal months, quarters, half and whole years.

<sup>&</sup>lt;sup>2</sup> Vide Journal Royal Soc. N.S.W., Vol. xlv., pp. 76-110.

however, of the results for different years in which the place of the movable feast is as different as possible, the effect of this distribution can be ascertained and corrections applied to eliminate the effect. The difficulty of a perfectly satisfactory solution will be apparent from Fig. 55 hereunder.

19. **Periodicities due to Easter.**—As ecclesiastically defined, Easter Day is the first Sunday after the 14th day of the paschal "Calendar Moon," a fictitious ecclesiastical moon, which is from one to three days later than the real moon. The average position of Easter for the century 1800 to 1899 is April 8.55 days, and for the century 1900 to 1999 is April 8.89 days, or say for the whole period of 200 years April 8.72 days. In Fig. 55 the Easters in each decade are shewn on a single line for the years 1800 to 1999 inclusive. An inspection of the figure shews that the points lie approximately on a series of 10 slanting lines, four days apart, these lines progressing at the rate of one half day per decade, and further that they are inversely symmetrical. For lines a, b, c, and e and a', b', c', and e' the symmetry is perfect: for lines d and d' however the symmetry is not absolutely perfect. It is evident that no means derived from two decades nor from periods of 19 years, nor from centuries are exactly comparable.

## POSITION OF EASTER FOR 200 YEARS.

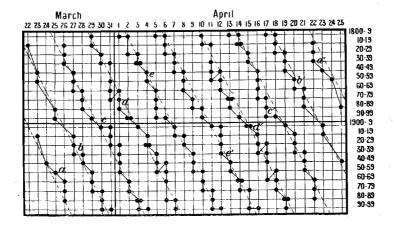


Fig. 55.

Since the tropical year =365.2422 days and the synodic lunar month =29.530588 days, the Metonic cycle, \*19 tropical years is 6939.6018 days, and 235 complete lunations equal 6939.6882 days, differing only .0864 day from the nineteen years.

The following table exhibits the peculiarities for successive decades.

TABLE XLIV.—MEAN POSITION OF EASTER FOR 200 YEARS.\*

0-9 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80-89 90-99		1800	•				1900.		
0-9 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80-89	Mean.	in	March	Mean of April Easters.	Decade	Mean.	in	Mean of March Easters.	April
	April.					April.			
0–9	9.46	1	29	9.56	0-9	10.56	2	30.5	13.12
10-19	8.16	3	25.67	13.57	10-19	8.36	3	27	12.86
<b>2029</b>	8.86	2	28	11.50	20-29	8.06	2	29	10.25
30-39	7.86	3	29	11.43	30-39	9.66	2	27.5	12.62
40-49	9.06	2 3	25	12.50	40-49	8.96	2	26	12 12
50-59	8.56	3	27	13.57	<b>50-59</b>	7.56	2	27	10.38
60–69	7.96	3	28.67	11.86	60-69	9.66	2	27.5	12.88
70–79	9.36	2 2	29.5	11.88	70-79	8.66	3	28.33	13.14
80-89	9.46	2	25.5	12.62	80-89	8.66	2	28	11.25
90–99	6.76	2	27	9.25	90-99	8.76	2	30.5	10.88
Means	8.55	2.3	27.48	11.70	Means	8.89	2.2	28.09	11.94

<sup>\*</sup> The complete Easter Cycle, restoring both the day of the week and of the month, is known as the "Dionysian" or "Great Paschal" period. Its length is 4.7.19 = 532 years.

To obtain a normal periodic fluctuation it would be preferable, were it practicable, to combine the results, each for a series of years such as would give Easter an identical distribution. In the period such a series is, however, impracticably long. Hence in the case of marriage, birth-rate, migration, etc., it is necessary to consider the actual effect on the periodic fluctuation studied. In respect of marriages the effect of Easter is to reduce the number of marriages in the Lent period (6 weeks) preceding, and to augment them in the preceding and following periods.

It may be noted that for the fluctuations of annual period in the marriage frequency, the great length of the Lent period, viz., 6 weeks, has the effect of throwing the increase of frequency as far back as February. The migration frequency is often thrown back into March. Thus, as is evident from the preceding table and the diagram, decennial means will clearly be nearly but not exactly comparable. The data for a thorough study of periodic fluctuation would in these cases have to be weekly groups.

### XII.—NUPTIALITY.

- 1. General.—The phenomena of reproduction have a double aspect, viz., one a sociological and the other a physiological. Thus, from the standpoint of a theory of population, both are important. The women of reproductive age in any community furnish the potential element of reproduction; but the resolution into fact depends also upon social facts as well as upon physiological; for example, the relative proportion of married and single, i.e., the nuptial-ratio, even more profoundly affect the result than physiological variations of fecundity. In Chapter XVIII. of the Census Report (Conjugal Condition), the numbers of married and unmarried females have been given as at 3rd April, 1911, in Australia. These will be considered mainly in regard to the child-bearing age, in dealing later with fecundity.
- 2. The Nuptial-Ratio.—The "nuptial-ratio," j, may be defined as the ratio of the married, J, to the unmarried, U, which latter may be taken generally as including the never married, the widowed, and the divorced. This ratio, J/U may apply to either sex and to any age, or age-group, or to the total for all ages, etc. The nuptial-ratio in any community may be regarded as a measure of the social instinct, and also a measure of the reproductive instinct, modified by social traditions as well as facilitated or hindered by economic conditions. This ratio, for the case of females, is, of course, specially important in relation to fecundity.

The significance of marriage in respect of reproductive activity depends upon the relative frequency of nuptial and ex-nuptial births, as well as upon the relative proportions of the married and unmarried, that is, it depends not merely upon the nuptial-ratio, but also upon nuptial and ex-nuptial fecundity, particularly during the reproductive period of life. The values of

$$(399)....j = J/U$$

for various countries are given in the following table for women during the reproductive period, and for women of all ages, viz., from age 0 to the end of life.

TABLE XLV.—Ratios of Married Women in various Age-groups to Unmarried Women in the same Groups. Reproductive Ages. Female Nuptial Ratios.

Ages of		Census,	•	C'wlth Aust.	Engla and W		Scotla	nd.	Irela	ınd.	Bel- gium.	Gern	any.
Women.	Metro pol'n.	Other.	Total.	1908.	1901.	1911.	1901.	1911.	1901.	1911.	1910.	1900.	1910.
10 to 14 incl 15 " 19 " 20 " 24 " 25 " 29 " 30 " 34 " 35 " 39 " 40 " 44 " 45 " 49 " 55 " 59 " 60 " 64 "	.0337 .03510 1.0945 1.8201 2.2491 2.5045 2.4617	1.6325 2.8810 3.5996 3.9037 3.6935 3.1420 2.3651	2.3318 2.8938 3.1586 3.0324 2.5634 1.9470	.0382 .4214 1.2997 2.4698 2.9805 3.1159 3.1068 2.6025 1.8482	3.0124 2.3915	.0000 .0121 .3184 (1,2645 (2,4565) (3.0299 (3.0747 (2.6855 (2.1756 (1.6585 (1.1481	.0000 .0767 0.3049 1.3759 2.2854 1.8199 1.0007	.0000 .0145 .2758 .9615 1.8345 2.3418 2.4112 2.0750 1.6795 1.3061 0.9089	1.4348	.0063 .1538	3.4697 3.3632 2.8921 2.2601	3.6381 4.2515 3.8012 3.0086 2.1635 1.4864	.0139 .3959 1.9359 3.8471 4.4905 4.0635 3.2488 2.3416 1.5995
0 ,, 105 ,,	.5231	.5198	.5218		.5159	.5528	.4293	.4516	.3543	.3765	.5781	.5200	.546

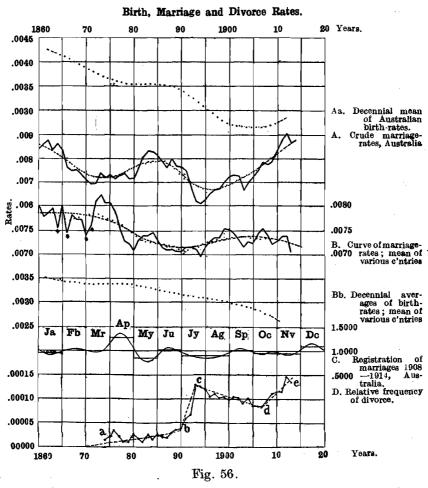
The results in the table shew that there are considerable divergences between populations as regards their nuptial constitution, consequently even if the individual fecundity were constant, the birth-rates would differ. The results of the Australian Census of 1911 shew also that there are striking differences between metropolitan and extra-metropolitan communities, the marriage-rate being very much higher for the latter; and they shew also that the nuptiality is very different as regards the sexes. See Vol. I., Chap., XVIII., Conjugal Condition, § 6, of the Census Report.

3. The Crude Marriage-Rate.—The lack of homogeneity in populations, illustrated in the last section, renders the crude marriage-rate, viz., the ratio of the marriages, J, to the population, P, of uncertain significance. The heterogeneity arises largely from divergences of social life and tradition, in respect of the relative frequency of marriage, and the frequency according to age. Inasmuch, however, as ordinarily the constitution of any population does not materially change, the marriage-rates for any particular country and for limited periods are comparable among one another, and their variations may generally be attributed to variations in the economic conditions of the population in question. Wars have, of course, a marked effect, see the points marked with asterisks, on Table XLVI., and also Fig. 56, giving the curve of the mean of the marriage-rates of a number of important countries. We shall denote the crude marriage-rate by n; thus—

$$(400)....n = J/P.$$

In some countries the marriage-rate is the ratio, not of the "marriages," but of the "persons married," to the population. In such cases the rates will be double those shewn in Table XLVI. hereunder, the which gives the marriage-rates for the countries for which in Table XXXIX. the crude birth-rates were given. This also gave the values of the marriage-rate. In Table XLVI., the mean in the final column is merely the unweighted mean, and is therefore not the rate for the aggregate of the populations. The trend, thus determined, treats each population as equally important in regard to the revelation of the secular tendency, if any, of the marriage-frequency. For the constitution of a norm a weighted-mean would of course be needed.

Fig. 56 illustrates the movement in the marriage-rate, and shews that movement in its relation to that of the western world generally (excluding America). Although the general trends shewn by broken lines of curves A and B, are by no means similar, there are often very similar fluctuations about this general trend, which appear readily enough if the general trend be regarded as a basic line about which the minor fluctuations may be regarded as moving.



Curve As shows the successive decennial means of the birth-rates of Australia, the central year being changed one year at a time.

Curve A shews the marriage-rates of Australia by the zig-zag line; the fine dots shew the successive decennial means; the broken line, closely following the decennial means, indicates the general trend.

Curve B shews the mean of the marriage-rates of a series of countries; the fine dots shew the successive decennial means of these; the broken line indicates the general trend of the marriage-rates.

Curve Bb shews the successive decennial averages of the means of the crude birth-rates of a number of countries.

Curve C shews the mean annual fluctuation of the registration of marriages in Australia for the period 1908-1914.

Curve D shews the relative frequency of divorce per unit of population for Australia, the portion ab being prior to acts facilitating divorce; be being the condition immediately following upon the passing of the facilitating Acts; ed, and de being the subsequent trends of the relative divorce-frequency.

As regards birth-rates and marriage-rates, it will be observed that here there is some indication of a correlation between the phenomena. This correlation will not, of course, be well-marked, since the aggregate

of "first births" is not large compared with "all births," But the trend of the Australian birth-rate shewn by Curve Aa is strikingly similar to Curve A shewing the marriage-rate, and Curve Bb gives some indication of its connection with Curve B.

TABLE XLVI.

Marriage-rates for Various Countries—1860-1913—per 10,000 of the Population.

										, ,,,,,,						
Year	Australia.	England and Wales.	Scotland.	Ireland.	France	Prussia.	Italy.	Switzerland.	Norway.	Sweden.	Denmark.	Netherlands.	Belgium.	Austria.	Hungary.	Means per 100,000
1860 1861 1862 1863 1864	84 86 88 84 86	86 82 81 84 86	70 68 67 72 72	  48	79 8 <b>2</b> 81 80 79	84 80 85 87 87	.: .: 80			78 73 71 73 70	75 74 75 57*	82 81 79 83 84	73 71 71 73 75	85 80 88 85 85		801 778 785 796 *756
1865 1866 1867 1868 1869	83 76 75 76 73	88 88 83 81 80	74 74 70 67 67	55 54 54 50 50	79 80 79 79 83	91 78 93 89 90	91 57* 68 72 80	67 72		71 67 61 55 57	89 84 77 73 74	85 84 84 77 77	76 79 78 73 74	78 65* 97 92 104	82* 104 137 110	800 *745 781 772 772
1870 1871 1872 1873 1874	71 <b>69</b> 70 74 72	81 84 87 88 85	72 72 76 78 76	53 54 50 48 46	61* 73* 98 89 83	74* 80* 103 102 97	74 75 75 79 76	70 73 79 77 83	67 70 73 77	60 65 70 73 73	74 73 75 81 82	80 80 83 86 84	70 74 78 78 78 76	98 95 93 94 91	98 104 108 113 107	*740 *759 810 822 805
1875 1876 1877 1878 1879	73 71 73 74 72	84 83 79 76 72	74 75 72 67 64	46 50 47 48 44	82 79 75 75 76	91 86 80 78 77	84 82 78 72 76	90 82 79 74 70	79 77 76 73 68	71 71 69 65 63	85 86 81 74 74	84 83 81 78 77	73 72 69 67 68	86 83 76 76 78	109 102 94 95 104	807 788 753 728 722
1880 1881 1882 1883 1884	72 76 81 84 83	75 76 78 78 78 76	66 70 71 71 68	39 43 43 43 46	75 75 75 75 76	77 77 79 80 81	70 81 78 81 83	69 69 69 69 70	67 64 67 66 69	63 62 64 65 66	76 78 77 77 78	75 73 72 71 72	71 71 70 68 68	76 80 83 79 80	92 100 103 105 103	709 780 740 741 746
1885 1886 1887 1888 1889	82 79 76 80 77	73 71 72 72 75	66 63 64 64 67	43 42 43 42 45	75 74 73 72 71	82 82 80 80 82	80 79 80 79 77	70 70 71 71 71	67 65 63 61 63	67 64 63 59 60	76 71 70 71 71	70 70 70 69 70	68 67 71 71 73	77 79 79 80 76	101 97 90 94 82	731 715 710 710 707
1890 1891 1892 1893 1894	76 75 67 62 61	78 78 77 74 75	69 70 71 66 67	45 46 47 47 47	70 75 76 75 75	82 82 81 81 80	78 75 75 74 75	70 71 72 72 72 72	65 66 64 65 64	60 59 57 57 58	69 68 68 70 70	71 71 72 73 72	73 74 77 76 75	76 78 78 80 80	82 86 92 94 93	706 716 716 711 696
1895 1896 1897 1898 1899	62 66 67 67 70	75 79 80 81 83	68 71 72 74 75	51 51 51 50 50	74 76 76 74 77	80 83 84 85 85	73 71 72 69 74	73 76 79 78 78	65 67 67 70 71	59 60 61 62 63	71 73 75 76 76	74 75 74 73 74	78 81 83 83 83	81 80 81 79 83	85 81 82 84 91	713 727 736 737 755
1900 1901 1902 1903 1904	72 73 73 67 70	80 80 80 79 77	73 70 71 72 71	48 51 52 52 52 52	78 78 76 76 76	86 83 80 80 81	72 73 73 72 75	78 76 74 74 74	69 66 64 60 60	62 61 60 58 59	76 72 71 71 72	76 77 76 75 74	86 87 81 79 80	83 82 78 78 78	89 88 87 82 92	752 745 731 716 727
1905 1906 1907 1908 1909	73 75 79 78 79	77 79 80 76 74	68 72 72 68 64	53 52 52 52 52 52	77 78 80 80 78	81 83 82 80 78	77 79 78 84 78	75 77 77 76 75	58 59 60 61 60	59 62 62 61 60	72 75 77 75 74	73 75 75 72 71	79 81 80 78 77	78 79 76 77 76	86 88 100 92 87	724 748 754 740 722
1910 1911 1912 1913 1914	84 88 91 87 88	75 76 78 78	65 67 69 71	51 54 53 51	78 78 79 75	78 80 80 	79 75 76	73 74 73 	62 63 62 63	61 59 59 59	73 72 73 72	72 72 75 78	79 80 80 	76 76 74	87 93 86 	729 738 739 704
M'ns	758	791	698	487	771	831	761	740	661	634	744	761	753	815	949	

Secular Fluctuation of Marriage-rates.—Fig. 56, embodying the results on Table XLVI., reveals the fact that the relative frequency of marriage has been increasing in Australia since 1897, although it has tended to diminish recently in the old world. It is apparent from a comparison of the two curves, A and B, that there is no very marked correlation between the two progressions. The factors influencing the relative frequency of marriage probably have a very unequal incidence in different countries. In order to obtain an accurate measure of reaction of the larger economic influences on the rates, statistics covering long periods of time will be required. The characteristics of the longer or secular fluctuations will fully appear only when much more statistical material is available than exists at present.

The period of the larger oscillations in the data shewn amounts to about 22 or 23 years in Australia, and about 30 or 31 years for the aggregate of the populations of the western world. The period of the minor fluctuations is very variable, and is somewhat ill-defined. In Table XLVII. are shewn the values of successive decennial means for the marriage-rates, and also for the birth-rates. These are shewn by dots on Fig. 56.

TABLE XLVII.--Decennial Unweighted Means of Marriage and Birth-rates, 1860 to 1909.

Deca	ahe		M	arriage	s per	100,000	of the	Popu	lation.		
Yes		186	30.	18	870.	18	<b>38</b> 0.	18:	90	19	00.
Yea	r.*	A	W	A	w	A	W	A	W	A	w
0				740	781	758	746	734	712	687	734
1				729	781	766	739	715	710	697	732
2				724	<b>78</b> 6	774	732	701	711	707	737
3				722	783	777	727	692	714	719	739
4	••		• •	721	778	783	725	6 <b>8</b> 0	716	729	739
5		812	779	719	773	788	724	673	721	740	735
6		799	773	719	770	793	723	669	726	749	733
7		782	771	726	767	792	722	668	729	764	732
8		764	773	737	760	778	720	673	730	782	733
9	• •	754	776	747	752	756	717	678	731	802	732
Dec	ade			D: 43				~			
Yes	<u>ar</u> .			Births	per 10	0,000	of the	Popul	ation.		
0				3,894	3,396	3,534	3,382	3,435	3,179	2,743	3,009
ı				3,832	3.397	3,532	3,365	3,382	3,161	2,702	2,984
2				3,793	3,397	3,526	3,343	3,313	3,142	2,683	2,960
$\frac{2}{3}$				3,739	3,400	3,532	3,326	3,239	3,122	2,669	2,935
4	• •	• •	• •	3,688	3,396	3,533	3,311	3,155	3,102	2,663	2,91
5		4,141	3,478	3,659	3,397	3,522	3,284	3,082	3,092	2,657	2,890
6		4,102	3,436	3,625	3,381	3,519	3,272	3,005	3,082	2,651	2,86
7		4,059	3,423	3,598	3,401	3,512	3,240	2,932	3,063	2,652	2,82
8		3,997	3,420	3,572	3,393	3,503	3,218	2,863	3,052	2,671	2,770
9		3,955	3,407	3,546	3.382	3.483	3,206	2,788	3,026	2,700	2,73

A denotes the values for the Commonwealth of Australia.

W denotes the values derived from the unweighted means for the series of countries shewn on Tables XXXIX and XLVI.

The moment of time to which the values apply is the beginning of the years 0, 1, 2, etc.....9.

5. Fluctuation of annual period in the frequency of marriage.—Social custom in regard to marriage expresses itself in a fluctuation of annual period, but the changes in the date of Easter make the results for any one year not comparable in general to those of any other. The movement of Easter has been already considered, see Part XI., Natality. The following results are for the period 1908-1914, and are corrected for inequality in the length of the month, and for an increasing population. The table gives the crude and the adjusted data.

TABLE XLVIII.

Number of Marriages Registered in the Different Months. Australia, 1908-14.

Period.	Jan.	Feb.	Mar.	April.	Мау.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908-14	21,462	21,106	22,732	28,358	19,714	22,959	20,752	20,733	22,824	22,138	21,140	25,534
Equalised	21,060	22,691	22,420	28,653	19,205	23,232	20,357	20,369	23,154	21,750	21,455	25,106
Constant Population	21,325	22,924	22,599	28,817	19,271	23,258	20,434	20,299	23,022	21,579	21,343	24,790
Ratio to Average	9490	1.0201	1.0057	1.2824	8578	1.0350	.9093	9033	1.0245	.9603	9498	1.1032

These results are shewn, the rectangles and the probable fluctuation, by curve C, on Fig. 56, and represent the fluctuation of the registration of marriage. It is not certain that the returns made to the Registrars of Marriages by those who celebrate them have not also seasonal peculiarities, and consequently the fluctuation shewn is compounded of the two, and in reference to the time scale is in advance of the true position. The components of the curve can be found by applying formulae (90) to (101) of § 5, part III., Determination of Constants, etc.<sup>1</sup>

6. General.—Conjugal Constitution of the Population.— The "general conjugal constitution" of a population is defined by the number of persons therein who have never been married; who are living in the state of marriage; or of widowhood, etc.; or who are living in the state of "divorced" persons. The actual unadjusted numbers of males and females in age-groups on the 3rd April, 1911, as indicated by the Census are shewn on the table of §4, Chapter XVIII., Vol. I., of the Census Report. These are represented on Fig. 57, which shews both the group-values and the curves, which give sensibly the same totals. The results as furnished by the Census are somewhat vitiated by misstatements as to age; on the whole, however, they give a fair representation of the change in the

<sup>&</sup>lt;sup>1</sup> See also formulae (375) to (395), § 16, Part XI., Natality.

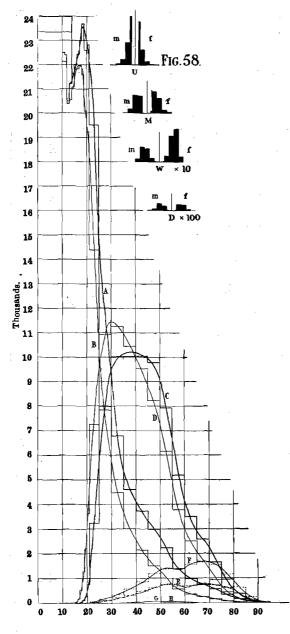


Fig. 57—The rectangles shew the total numbers as at the Australian Census of 1911 in 5-year groups, and the curves give approximately the equivalent areas, the heavy curves denoting the results for males, and the light those for females. Curves A and B shew the numbers of the "Never married"; C and D the numbers of the "married" E and F the numbers of the "widowed"; the former being for males; and G and H (which cannot be distinguished) shew the numbers of the divorced."

Fig.58—The figures, which illustrate Table XLIX., shew the asymmetry of the distribution for the "never married," M; the "widowed," W; and the "divorced." The scale of W is ten times that of U and M, and that of D is 100 times that of U and M.

Fig. 57.

conjugal constitution with age. The general significance can be better grasped from the results shewn in the following table:—

TABLE XLIX.—Proportional Conjugal Constitution of the Australian Population, 3rd April, 1911, per 10,000,000 Total Population (Adjusted Numbers.)

Age-groups.	Pro	portion per Pop	10,000,00 pulation.	00 of To	tal	Proport same	ion per Sex and	1,000,00 Age-grot	
	Never Married.	Married.	Wid- dowed.	Dî- vorced	Total.	Never Married.	Married.	Wid- owed.	Di- vorced
Under 14 M	1,506,806 1,467,395	0 2	0	0	1,506,806 1,467,397	1,000,000	0 2	0	
14 to 20 M	710,197 662,798	5,804 35,358	34 184	18	715,539 698,358	992,533 949,080	7,413 50,630	48 264	
21 to 39 M	875,496 602, <b>222</b>	699,580 862,948	14,646 24,658	1,731 2,265	1,591,453 1,492,093	550,123 403,609	439,586 578,347	9,203 16,526	1,088
40 to 59 M	231,079 116,157	746,217 621,059	55,057 107,535	2,941 2,229	1,035,294 846,980	223,201 137,142	720,778 733,263	53,180 126,963	2,841
60 to 79 M	58,438 18,608	194,935 124,159	61,309 134,718	595 285	315,277 277.770	185,854 66,991	618,297 446,985	194,461 484,998	1,888
80 & a bove M F	4,507 1,129	10,770 3,850	12,301 20,424	45 7	27,623 25, <b>4</b> 10	163,161 44,431	389,893 151,515	445,317 803,778	1,629
All Ages M F	3,386,523 2,868,309	1,656,806 1,647,374		5,315 4,804	5,191,992 4,808,008	652,259 596,569	319,108 34 <b>2,6</b> 32	27,609 59,800	1,024

The table is based upon 4,455,005 persons, of which 2,313,035 were males, and 2,141,970 were females; it shews the distribution of 10,000,000 persons on that basis. The ratios in the second part of the table shew the proportional distribution in each age group. This distribution is illustrated in the small diagrams of Fig. 58, in which U denotes the males and females belonging to the class "never married"; M denotes the "married" males and females; W denotes the "widowed," of each sex; and D the divorced of each sex. These small diagrams represent by the rectangular areas on the left of the median line the males, and on the right thereof, the females. The scale of U and M is identical; that of W is 10 times, and that of D, 100 times as great.

The age at which the married are equal numerically to the unmarried is about 29.49 for males when the proportion of the total at that age is 0.49557, and 25.27 years for females when the proportion at that age is 0.49699. The difference is 4.22 years, and the mean proportion 0.49629 is close to either. This is due to the fact that the number of widowed and divorced is very small at the ages in question.

7. Relative conjugal numbers at each age.—The progress of the conjugal constitution with age is completely defined by giving for each sex, the proportion living at each age, and the proportional division of each such number according to conjugal condition. In the following table, which represents the smoothed results for the population of Australia at the Census of 3rd April, 1911, the relative distribution of males and females is shewn in columns II. and III. These numbers multiplied by 0.2313035 in the case of males, and 0.2141970 in the case of females (see the preceding section) give the absolute numbers, smoothed. The distribution of 100,000 of these at each age is given for each conjugal condition, viz., in IV. and V., the unmarried; in VI. and VII., the widowed; and so on. Thus at each age a complete comparison is

possible of the conjugal state. Assuming the constancy of the conjugal constitution of the population the results given in columns IV. to XII. are the probability of the number of males or females which will be found characterised as never married, married, widowed or divorced, in a total of 100,000 males or females of each year of age throughout life. Columns II. and III. shew, for the population of 10,000,000, a probable number of males or females living at each year of age throughout the life-period on the assumption of an unchanging constitution according to sex and age. As a matter of fact the Australian population, however, has not reached a "steady" state as regards the constitution of its population.

TABLE L.—Relative Conjugal Numbers at each Age. Australia, 3rd April, 1911.

	10,000,	ion per non of								
Age Last Birth-	same		Ne Mar		Ma	ried.	Wide	wed.	Divor	ced.
day.	Males.	Fe- males.	Males.	Fe- males.	Males.	Fe- males.	Males.	Fe- males.	Males.	Fe- males
L	II.	m.	1V.	V.	VI.	VII.	VIII.	IX.	x.	XII.
0	253,554 236,741	263,314 247,852	100,000 100,000	100,000			• •		••	• •
1	236,741 227,662	247,802	100,000	100,000			• • •		••	• •
2 3	221,173	238,776 232,426	100,000	100,000	• • •	::	• •	::	• •	• •
4	216,158	226,689	100,000	100,000	::	::	• • • • • • • • • • • • • • • • • • • •		::	::
5	211,030	221,422	100,000 100,000	100,000						
6	205,544	216,147	100,000	100,000			••	• • •		
7	199,236	210,605	100,000	100,000		•••	• •	• •	. • •	• •
8	193,611 189,232	$205,675 \\ 201,852$	100,000 100,000	100,000		••	• • •	••	(	• •
	109,232	•		1			••	• • •	)	• •
10	186,115	199,135	100,000	100,000		••				••
11	184,835	197,118	100,000	100,000	••	••	••	•••	••	• •
12 13	184,813 185,860	196,086 196,417	100,000	100,000	• • •	''2	••	• • •	•• }	• •
14	188,588	198,425	99,993	99,958	7	42	::	::	::	• • •
15	192,846	202,463	99,982	99,783	18	215		2		
16	196,742	206,660	99,945	99,207	55	789		4		
17	200.105	209,910	99,842	97,445	156	2,547	2	8		
18 19	202,552 203,339	212,020 212,575	99,507 98,803	94,363 90,089	491 1,191	5,621 9,878	2 4	15 27	2	1 6
			'			15,290	-	59	- 1	
20 21	202,932 201,908	211,646 209,144	96,862 93,784	84,638 77,311	3,111 6,156	22,547	23 54	121	6	13 21
22	200 256	205,554	88.724	70,131	11,172	29.634	93	204	11	31
23	197,226	200,885	82,292	61,261	17,537	38,393 45,192	153	302	18	44
24	197,226 192,582	195,288	88,724 82,292 76,334	70,131 61,261 54,327	23,403	45,192	236	418	27	63
25	186,746	189,284	70,235	48,343	29,402	51,018	326	555	37	84
26	180,702	183,033	64,175	44,043	35,349	55,149	426	701	50	107
27	174,619 168,700	177,047 171,165	58,423 53,325	40,529	40,975	58,487 61,599	535 654	857	67 84	127
28 29	163,700	165,339	53,325 49,526	40,529 37,220 34,316	45,937 49,586	64,280	782	1,036 1,242	106	145 162
30	-	159,615	45,773	31,703	53,169	66,641	918	1,477	140	179
31	152 938	154 158	42.050	29.253	5 <b>6</b> .73 <b>2</b>	68.827	1.060	1.726	158	194
32	157,732 152,938 148,316 144,192	154,158 149,297	42,050 38,623	29,253 27,299 25,742	56,732 59,998 62,703	70,490 71,732	1,210 1,365	2,001 2,303	169	$\tilde{\mathbf{z}}_{10}$
33	144,192	144,913	35,755	25,742	62,703	71,732	1,365	2,303	177	223
34	140,534	141,029	33,532	24,593	64,757	72,523	1,523	2,648	188	236
35	137,417	137,532 134,166	32,018 30,608	23,352	66,100 67,326 68,252	73,362	1,687	3,038	195	248
36	134,594	134,166	30,008	22,188 21,236	07,320	74,092	1,860	3,462	206 212	258
37 38	132,387 130,491	131,164 128,344	29,495 28,536	21,236	69,012	74,546 75,059	2,041 2,233	3,951 4,456	212	267 276
39	128,870	125,725	27,727	19,392	69,612	75,368	2,436	4,957	225	283
40	127,499	123,036	27.035	18.423	70,089	75.785	2.645	5,504	231	288
41	126,085	120,006	27,035 26,296	18,423 17,585	70,601	75,785 76,023 76,272	2,645 2,867	6,100	236	292
42	124,753	116.766	25,596	16,697	71,060	76,272	3,098	6,737	246	294
43	123,297	113,820	24,815	16,111	71,584	76,108	3,345	7,486	256	295
44	121,810	111,075	24,004	15,481	72,121	75,913	3,606	8,311	269	295

Relative Conjugal Numbers at each Age. Australia, 3rd April, 1911.—Continued.

	Proport	ion per	Prop	ortion per	100,000	of any A	ge in eac	h Conjug	al Condi	tion.
Age Last Birth day.  I. 456 477 488 49 50 1512 558 56 578 59 60 1612 68 69 70 172 778 79 80 182 83 84 86 86 77 778 79 80 182 83 84 86 86 79 778 79 80 182 83 84 86 86 79 778 79 80 182 83 84 86 86 79 778 79 80 182 83 84 86 86 79 79 80 182 83 84 86 86 79 79 80 182 83 84 86 86 79 79 80 182 83 84 86 86 79 79 80 182 83 84 86 86 79 79 80 182 83 84 86 86 79 79 80 182 83 84 86 86 79 79 80 182 83 84 86 86 79 79 80 182 83 84 86 86 79 79 80 182 83 84 86 86 79 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 79 80 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 86 70 182 83 84 86 80 80 80 80 80 80 80 80 80 80 80 80 80	10,000, same	DOD OI	Nev Marr		Mar	ried.	Wido	wed.	Divo	rced.
	Males.	Fe- males.	Males.	Fe- males.	Males.	Fe- males.	Males.	Fe- males.	Males.	Fe- males.
45 46 47 48	II. 120,227 118,632 116,738 114,201 110.863	III. 108,316 105,580 102,742 99,455 95,281	1V. 23,205 22,540 22,062 21,696 21,573	V. 14,831 14,203 13,632 13,064 12,592	VI. 72,620 72,959 73,124 73,159 72,924	VII. 75,875 75,593 75,231 74,888 74,455	VIII. 3,887 4,195 4,503 4,831 5,191	1X. 9,000 9,911 10,846 11,760 12,668	X. 288 306 311 314 312	XII. 294 293 291 288 285
51 52 58	106,112 99,890 93,841 86,985 80,868	90,165 84,049 78,320 73,129 68,376	21,317 20,762 20,065 19,593 19,471	12,216 11,745 11,362 11,034 10,676	72,747 72,755 72,858 72,763 72,387	73,959 73,183 72,254 71,200 70,127	5,627 6,172 6,767 7,336 7,837	13,545 14,798 16,118 17,511 18,961	309 311 310 308 305	280 274 266 255 236
56 57 58	74,798 68,840 62,865 57,474 53,237	63,726 59,053 54,585 50,631 47,302	19,317 19,105 18,994 18,896 18,694	10,315 9,966 9,658 9,316 9,031	72,094 71,915 71,433 70,806 70,294	69,009 67,531 65,772 63,932 62,064	8,300 8,704 9,291 10,012 10,728	20,484 22,342 24,427 26,611 28,770	289 276 282 286 284	192 161 148 141 135
61 62 63 64	49,602 46,433 43,873 44,724 39,870	44,622 42,424 40,678 39,258 37,904	18,757 18,920 18,940 18,879 18,781	8,754 8,434 8,156 7,741 7,556	69,406 68,371 67,491 66,677 65,853	60,052 58,108 55,959 53,939 51,569	11,558 12,439 13,313 14,206 15,138	31,063 33,332 35,763 38,202 40,761	279 270 256 238 228	131 126 122 118 114
65 66 67 68	38,149 36,376 34,574 32,771 30,912	36,588 35,276 33,782 32,078 30,164	18,382 17,709 17,457 17,520 17,790	7,256 6,879 6,690 6,409 6,068	65,254 64,547 63,524 62,309 61,063	49,263 47,147 44,855 42,859 40,966	16,160 17,542 18,832 20,000 20,979	43,371 45,868 48,353 50,634 52,872	204 202 187 171 168	110 106 102 98 94
71 7 <b>2</b> 73	29,096 27,341 25,460 23,562 21,669	28,194 26,359 24,608 22,890 21,121	18,276 18,817 19,358 19,817 20,152	5,861 5,668 5,422 5,185 5,131	59,406 57,938 56,563 55,468 53,990	38,856 36,880 34,905 33,008 31,012	22,140 23,087 23,943 24,587 25,788	55,194 57,367 59,592 61,730 63,784	178 158 186 128 120	89 85 81 77 73
<b>76</b> <b>7</b> 7 78	19,861 18,123 16,459 14,639 12,568	19,281 17,400 15,453 13,441 11,545	20,026 19,323 18,125 16,539 15,480	4,858 4,759 4,649 4,558 4,466	52,024 50,334 48,595 47,549 46,784	29,141 27,327 25,442 23,500 21,890	27,841 30,248 33,202 35,824 37,668	65,932 67,849 69,848 71,885 73,591	109 95 78 88 68	69 65 61 57 53
81 82 83	10,817 9,023 7,263 5,824 4,630	9,762 8,189 6,830 5,640 4,650	14,788 14,950 15,833 16,704 17,647	4,871 4, <b>2</b> 91 4,236 4,150 4,080	43,965 42,166 41,072 39,347 37,348	20,214 18,556 16,882 15,183 13,495	41,167 42,789 42,976 43,875 44,912	75,366 77,109 78,842 80,667 82,425	80 95 119 74 93	49 44 40
85 86 87 88 89	3,662 2,882 2,166 1,634 1,258	3,842 8,142 2,516 1,975 1,536	18,654 18,473 17,964 17,196 15,808	4,012 3,960 3,891 3,830 3,770	35,419 33,588 31,936 31,746 31,615	12,063 10,288 8,809 7,754 7,264	45,809 47,786 49,900 50,794 52,234		118 153 200 264 343	••
90 91 92 93 94	968 7 <b>22</b> 53 <b>2</b> 363 233	1,186 878 616 416 280	14,732 15,569 16,260 17,857 20,370	3,720 3,681 3,640 3,601 3,563	30,357 28,743 26,016 23,810 22,222	7,204 7,5 <b>21</b> 8,581 9,882 11,537	54,464 55,688 57,724 58,333 57,408	  	447	
95 96 97 98 99	169 125 99 78 61	210 159 117 84 61	20,513 20,690 21,739 22,222 21,429	3,534 3,501 3,470 3,446 3,427	20,513 24,138 26,087 27,778 28,571	13,044 14,746 16,630 18,276 20,050	58,974 55,172 52,174 50,000 50,000			  
100~	43	42	20,000	8,411	30,000	21,811	50,000			
Total	10,000,000	10,000,000							• • •	

8. The curves of the conjugal ratios.—The smoothed results for each sex, representing the ratios which the "never married," the "married," the "married," the "widowed" and the "divorced" bear to each other (given in Table L) are graphed in Fig. 59, and are represented respectively by the curves  $\mathbf{U}_m$  and  $\mathbf{U}_f$ ,  $\mathbf{M}_m$  and  $\mathbf{M}_f$ ,  $\mathbf{W}_m$  and  $\mathbf{W}_f$ , and  $\mathbf{D}_m$  and  $\mathbf{D}_f$ .

## Conjugal Ratios, Australia, 1911.

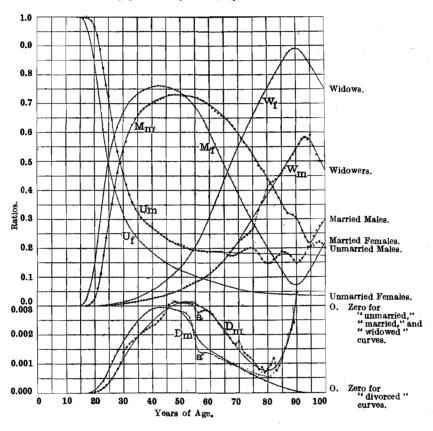


Fig. 59.

These curves shew merely the proportion of the unmarried, married, wildowed, and divorced at each age, the number at *each* age being unity for males, and also unity for females. They thus shew the distribution for each age according to age, but not between one age and another.

The results for males are shewn by small crosses in the figures; those for females by small dots. The curves for the "never married" are somewhat of the type  $e^{nx^p}$ , where p is large. The critical features of these curves can be best shewn in a tabular form, and are as in the following table:—

TABLE LI.—Critical features in the frequencies of conjugal conditions.

Australian Census, 3rd April, 1911.

Character of Critical Feature.	Exact Age.	Proportion of Total Age-group.
Maximum proportion married, males	. 49.5	0.73100
,, females	. 43.0	0.76160
,, ,, ,, lemales Minimum proportion married, males	. 95.0	0.00217
	. 90.0	0.00063
", ", ", females Equal frequency married and unmarried males	. 29.49	0.49556
,, ,, ,, females .	. 25,27	0.49699
Maximum proportion widowed, males	. 90.5	0.89100
	. 93.7	0.58400
,, iemales Equal frequency unmarried and widowed, males	. 67.5	0.18600
£	. 49.5	0.12600
,, ,, ,, ,, iemales	. 52.0	0.003115
,, ,, females	. 44.0	0.00295

In general these results are for the smoothed curves represented in Fig. 59, as may be seen by a reference thereto. The ratios among one another of the various ratios given in Table L follow no simple law, and an examination of them was found to lead to no important results.

- 9. The norms of the conjugal ratios.—It is eminently desirable that a series of curves based upon the aggregate of all populations to be compared, should be tabulated and constructed on some such model as that indicated here for the population of Australia. Such a norm, representing the relative frequency of the never-married, the married, the widowed and divorced for the entire aggregate would constitute the best possible bases for comparisons of the position of individual nations and peoples. The international issue of graph paper on which such curves were already drawn, preferably in faint colour, would enable the statistician to see instantly the position of his own country in regard to the larger average in respect of the particular character compared.
- 10. Divorce and its secular increase.—The frequency of divorce is of sociological interest. The effect of the Divorce Act (55 Vict., No. 37) of New South Wales, and of Victoria (53 Vict., No. 1056), which came into force on 6th August, 1892, and 13th May, 1890, respectively, have had a conspicuous influence in increasing its frequency. In the former State the frequency was more than quadrupled for about three years; in the latter it was tripled, as the result of the operation of these Acts. Table

LII. shews the frequency of divorce per 10,000,000, for the several States of the Australian Commonwealth for which they were available up to 1886, and for the whole Commonwealth from 1887 onward.

The populations up to 1886, used to compute the divorce-rate, correspond to the number of States for which the divorce results were available, and the number of divorces include the judicial separations. The results for the successive years are as follows:—

TABLE LII.—Relative Frequencies, per 10,000,000 population, of Divorces and Judicial Separations. Australia, 1874 to 1913.

Year		R	ates* in	Decades.		Proportion† Separat	
of Decade. 0 1 2 3 4 5 6 7	1870.	1880.	1890.	1900.	1910.	Period.	Pro- portion.
0	• •	237 179	377 594	981 1.052	1,066 1,154	1874–1879 1880–1884	.020 .052
2		113	684	1,032	1,164	1885-1889	.062
3		274	1,293	909	1,347	1890-1894	.043
4	140	176	1,261	1,014		1895-1899	.038
5	220	269	1,194	862		1900-1904	.042
6	350	<b>229</b>	1,039	860		1905-1909	.043
7	210	205	1,113	854		1910-1913	.023
8	140	297	1,024	997		1874-1913	.0381
9	120	361	1,043	1,163		• •	

<sup>\*</sup> Number per 10,000,000 of population. † Ratio of judicial separations to judicial separations and divorces together.

The total number of divorces and judicial separations were 10,194 and 404 respectively, the total thus being 10,598. The relative frequencies, tabulated above, are shewn by the bottom curve in Fig. 56, viz., curve D. The proportions which judicial separations bear to the totals appear also in the table. Apparently divorce was increasing at first approximately at the rate 0.00000165 per unit of the population per annum, so that the number of divorces (V.) from 1781 to 1890 would be represented roughly by

$$(401)....V = 0.00000165 P (t - 1870),$$

in which formula t denotes the year for which the number is required, and P the population at the middle of the year.

The values according to this formula are denoted by the dotted line a b on Fig. 56. The relative frequency then rises in 3 years from, say 0.0000330 to the value 0.0001293; that is at the rate 0.0000321 per

person per annum — the line b c on the figure. The relief afforded through the change in the divorce acts, having apparently been secured in the short time mentioned, the relative frequency of divorce fell fairly regularly until about 1907, viz., at the rate of 0.00000333 per person per annum. Hence for this period the relative frequency is about

$$(402)....V = -0.00000333 P (t - 1893).$$

This is the line c d on the graph. The relative frequency of divorce then rapidly increases to about 0.0000100 per person per annum. This is denoted by line d e on the graph.

11. The abnormality of the divorce curve.—Owing to the change in the divorce law being, as shewn, instantly followed by a large increase in the number of cases, the curve of frequency cannot be regarded as normal for the larger ages. For the purpose of estimating the rate of increase, previous to the legal change, the results for a few years before the change can be used. Similarly the results after the change can be carried backward to some common year in the changing period. This gives the following results:—

TABLE LIII.—Shewing Influence of Divorce Acts on Number of Divorces.

Australia.

		Increase per (Number).	Number as per Year		Factor
State.	Before Legal Change	After Legal Change	Before Change.	After Change.	of Increase
N.S. Wales Victoria Commonwealth	(1881-1889) 1.9	(1893-1895) 0.0 (1891-1893) 0.0 (1893-1907) 5.6	32.5	306.7* 91.7 436.6	4.4 2.8 3.7

<sup>\*</sup> Divorces and judicial separations together.

In view of the fact that, as shewn, the change consequent upon the operation of the Divorce Acts is very marked in the frequency of divorce between 1890 and 1893, say 21 to 18 years before the Census of 1911, and that there is a remarkable decrease in the proportion of "divorced" for

ages about 55, see the points marked a and a' in Fig. 59 (which would correspond to ages of about 35 in the year 1891), it seems more than probable that the left-hand branch of the divorce curves belongs to the later, and the right-hand branch belongs to the earlier divorce regime. To obtain the true tendency to divorce according to age of the parties, these irregular frequencies would, of course, have to be eliminated. Hence it is desirable to include in the statistics of divorce the age of petitioners and respondents. See later.

- 12. Desirable form of divorce statistics.—From what has preceded, it is evident that for divorce statistics to be of high value from the standpoint of sociology, they should fulfil the following requirements, viz., they should include the numbers both of petitions for judicial separation and for divorce, and should shew for each:—(1) The date and the ground of the petition; (2) The action resulting therefrom (granting, refusal, or other action), together with the date of such action; (3) The date of birth both of petitioner and respondent; (4) and the date of their marriage. Statistics so kept would furnish results shewing frequency-according-to-age and age-differences and according to duration-of-marriage. The sociological value of such statistics is self-evident, for it would throw light upon the influence of age per se, of difference of age, and of duration of marriage, and thus would expose the conditions which are of danger from the standpoint of social stability.
- 13. Frequency of marriages according to pairs of ages.—The frequency of marriage according to pairs of ages can be well determined only for a considerable number of instances. For example, if assigned to groups, according to age last birthday, there are, between the ages 12 and 95 for brides, and 15 and 99 for bridegrooms, no less than 7140 groups. As for the last eight years the average number of marriages per annum was only 37,740, this gives a little over 5 per group on the average, a number insufficient to indicate the characteristics of the frequency. For this reason eight years marriages were taken, viz., 301,918, or the marriages of 603,836 persons, who were married during the years 1907 to 1914 inclusive. Of these marriages the ages of 57 brides were not stated, though the ages of the bridegrooms were given; the ages of 19 bridegrooms were not furnished, though those of the brides were given; and in 54 cases neither the age of bride or bridegroom was given. there were 130 cases (or about 1 in 2322, or the 0.00043058th part) defective. These are disregarded.

For single year groups the numbers of marriages are shewn in Table LIV.

# TABLE LIV.—NUMBER OF MARRIAGES\* ARRANGED ACCORDING TO

\* The figures denote the number

															AGES	OF B	RIDE	s.		_										
res de- oms	12	13	14	15	16	17	18	19	20	<b>2</b> 1	22	23	24	25	26	27	28	29	30	31.	32	. 33	34	35	36	37	38	39	40	4
5 6 7 8		 : :	2 3 2	2 12 28 38	1 8 44 113	233	 8 51 309	 6 30 195 740	1 3 16 112 395	2 4 10 78 327	 3 8 58	  5 30	 :: i2	1 1 1 111	  3 6	 1 	··· ··· <sub>2</sub>	··· ··· 6	:::	1	::		·· ·· ·· 1	 :: :: <sub>1</sub>	::	::	::	::		
9 10 12 33		1 2	8 10 16	37 65 68	208 214 362 266 233	602 1158 870	778 1033 2076 1703 1494	1261 2527 2342	395 1075 2301 2384 2550	327 891 3764 3960 4114	194 489 1845 3008 3468	90 320 1185 1869 3128	160 738 1269 2032	124 465 744 1247	776 289 526 835	42 190 307 513	28 118 226 309	29 73 134 231	17 58 78 179	34 34 51 82 132	5 24 59 84	7 15 17 63 61	5 19 20 30	3 19 16 30	3 8 10 20 34	 2 4 4 13	 5 6 22 21	2 5 4 11 15	 4 4 6 8	1
5 6 7 8			7 1 2 6 2	40 32 38 25 16	195 157 158 97	603 460 405 311	971 875 607	1885 1458 1197 985	2267 1824 1627 1238	3672 3170 2630 2171	3302 2981 2555 2050	3249 3006 2683 2255	2989 2821	1776 2664 2382 2073	1311 1616 2200 1844	769 1089 1354 1723	545 832 948 1098	395 450 584 730	360 424 490	206		78 124 154 203 260	72	75 64 86	35 48 55	27 26 30 76	25 26 35	15 19 24 31 38	11 17 20 35 25	
		•••	6 2 1	19 10 7 6	46	182	567 339 287 186	775 606 439 311	1036 766 609 402	1858 1364 1022 727	1783 1353 986 737	1873 1431 1088 769	1484	1736 1457 1172 820	1668 1317 1183 841	1532 1242 982 752	1320 1121 944 754	879 1037 830 703	590 709 742 599	423				132	100	66 66 76 76	53 60 61 46 67	- 1		1
0 1 2 3 4				9 2 5	27 29 22 12	1 [	154 114 121	259 193 157 126	344 261 215	604 462 334 304	710 513 366	668 553 422 313	786 727 512 551 364	820 767 549 455	790 563 432 375	621 536 449 398	673 541 449 387	636 517 407 354	555 461	555 472 355 264 270	365 339 497 342 344	275	298		126 130 157 164	94 90 95	67 64 95 94	33' 48' 42' 50' 66'	46 23 41 36 35	1
5   5   7   8   9			1 1 1	6 3 1 4	18 13 7 8 8	26 37 27 22 18	81 76 40 47 28	93 90 74	129 101 75 58	241 188 181 125	323 272 171 178 113	273 259 205 128	300 236 259 164	323 242 250 177	368 263 216 204	337 327 215 190	324 254 354 197	333 250 240 243	362 255 243	239 167 193 160	288 258 227 216 168	246 228 194 216 169	235 223 178 178 174	190 153 187 154	188	103 126 165 160 142	115 111 189 139	87 75 103 120 151	63 61 56 84 101	H
0 1 2 3 4			i i	5 1 1	9 2 3 2 3	13 6 1 3	18 14 22 6 10	21 26 18	71 26 34 21 17	90 70 52 39 41	110 53 70 42 36	112 87 64 72 49	138 87 88 59 48	157 85 84 64 57	139 122 84 68 62	161 109 112 93 64	172 116 114 91 65	180 108 106 81 70	208 119 131 110 74	121 142 107 84 66	152 117 135 105 96	132 115 110 101 80	128 93 98 97 90	173 106 132 96 72	101	124 73 86 88 68	126 76 111 85 80	124 86 97 81 84	118 70 73 71 67	
5 6 7 8	i	•••	  i	1 1	4 3 1	5 4 6 3	14 5 6 10	12 13 8 7	12 15 14 14	35 38 30 16	23 29 21 15	37 32 21 37	45 37 24 32	72 43 26 30	45 52 29 27	51 44 48 30 32	72 50 52 49	79 56 36 44 29	92	75 57 38 42 31	61 63 46 47 39	72 62 49 49	86 57 60 48	93 88 65 44 48	95 87 64 55 58	77 48 74 66 50	73 66 69 81 58	78 54 47 60 55	65 62 47 61 48	
9 0 1 2 3 4		•••			1  1 2	4	4 6 2 3 1 2		6 6 5 3	8	20 9 8 11 6	15 15 5 7 9	21 23 8 11 4 8	27 28 8 10 14	26 26 16 9 11	24 10 21 11	28 22 9 12 12	31 20 12 19	37 20 16 13	32 24 25 19	34 13 25 17	19 38 26 20 14	27 23 18 14	52 28 32 22 19	40 38 24 21 24	41 20 22 23 14	54 36 40 26 20	57 34 34 27 20	66 29 31 29 26	
	12	 13	14	15	<u></u>	17	18	19	20	$\frac{3}{21}$		23	8 24	$-\frac{7}{25}$	18 26	$-\frac{9}{27}$	$-\frac{12}{28}$	13 29	30	31	19 32	19 33	24 34	19 35	24 36	37	38	39	26 40	-
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5 6 7 8				::		   		 1	1 2 ··· <sub>2</sub>	ĺ		 1  1	 3 	  2	 2 1 1 1		2 1 1 1 8	1 2  3 1	3		 1 	2 3 1 2	اہ		2 5 2 	8 2 3 4 2	4 2 1 3	4 1 5 2 1	4 4 3 3	
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5 6 7 8			••		::	   ::   ::	:: :: :: 1	••	 1 1	 	::			::	<sub>1</sub> ::	::	••	 1	::	1 2 	:: :: <sub>1</sub>	1	 1 		<sub>1</sub>	1	1	  1	1 2 1	
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5 6 7 8		••	••					••		::	••		::		••												::			
9 0 5 9	•••	• • • • • • • • • • • • • • • • • • • •	• •										•••	::	•••	:			::				••	•••	••			::		
s.							1	1	1	4	2	• •	``1	1		2			1	1		1								

# THE AGES OF THE CONTRACTING PARTIES, AUSTRALIA. 1907-1914.

of couples: not of persons.

AGES OF BRIDES.  Ages of Brides.													Ages																											
42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61 6	32 63	64	65 6	67	68	69	70 71	72	73	74 7	75 76	77	78	798	81	828	838	495	Not stated	Total.	of Bride- grooms
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 1 1 4 6	1 3 1 3 1	$\frac{1}{2}$	3 1 1 3	 3 1 2	  1	 1 2 1	1 1 1 1		::	i	::		::	::	 i 	::	:::::::::::::::::::::::::::::::::::::::	· · · · · · · · · · · · · · · · · · ·						    					٠٠ ٠									1 2 2 2	6438 17374 19977 23655 24918	20 21 22 23 24
9 8 15 8 8	5 7 9 8 7	2 3 4 6 15	l	_	2 2 3 1 3	2 4 1 5 2	2 2 2 3 4	1 2 2 3 1	  i	   1	1	1 1 1 	::	::		1  	::	::		i .			i								::							2 4 2 2 4	24650 23494 21012 19384 16113	25 26 27 28 29
20 21 25 25 28	10 12 19 27	10 6 14 10 20	11 7 16	6 9 12	6 3 7 3 6	5 3	2 1 2 	3 1  4 3	1	2 1 3 1	i	 1 	::	1 1 	i i i		:::::::::::::::::::::::::::::::::::::::			i																		2 2 4 1 2	13392 10349 9745 7712 6796	30 31 32 33 34
27 30 31 43 61	30 24 27 38 37	21 15 18 27 35	20   20	7 6 8 20 21	8 7 10 13 14	6 7 12 24 8	4	7 2 3 2 11	5 5 2 2 2	1 4 4	3  1 3	$\begin{array}{c}1\\2\\ \cdot \cdot \\3\\2\end{array}$	 3  2	 1 1	1 1 1 1	 2 1 	:::::	1  						1  1														2 1 2 2 2	6066 5345 4411 4530 3737	35 36 <b>37</b> 38 39
58 61 87 90 56	33 52 42 73 56	30 28 42 46 53	31 34 29	15 23 15 19 32	18 22 26 12	13 20 14 13	10 6 10 12 15	10 6 6 8 13	3 6 7 4 2	50000	2 3 1 2 6	3 1 3 ··	 1 5 2	 1 2	2 2 ··2 2	1 2 1 	1  1	1 1 	1 .	i				     	i i													1 2 2 1 1	3252 2336 2437 2058 1745	40 41 42 43 44
75 59 56 60 39	78 58 50 39 42	40 49 41 36	55 49 42	51 42	29 34	13 31 27 43 23	20 12 10 31 35	24	10 7 15 18	5 13 12 8 18	5 5 4 7	7 5 8 5 4	6 2 4 4 7	2 5 3 ··	2 3 2 7 4	 2 3 4 2	1 1 1 2	··2 3 3 7	: i	1 1 2 1 4	2						•••											1 1 1 1	1847 1575 1350 1363 1146	45 46 47 48 49
32 24 44 33 19	30 27 23 37 24	30 31 40 25 30	29   27	35 18 34 18 26	29 35	36 29 29 23 26	40 32 22 15 16	32 24 25 17 19	12 16 20 13 17	15 16 24 19 19	10 14 8 15 16	9 9 12 16	5 2 3 9 7	7 8 9 7 10	6 3 1 6 4	4 6 3 2 8	2 1 2 1 1	2 3 4 1 4	3.	1 1 1	1	1	1	1	  1	i	• •	i .		i									1113 748 795 647 623	50 5 <b>1</b> 52 53 54
42 23	43	17	20	46 20						52 14	53	54		56	57 3	58	59			4 4	64	65 66	-		69	70 71	72	73 7	4 7	5 76	77		798	0 81	82 8	338	<b>1</b> 95	2	Total.	Ages.
23 15 13 9 5	16 13 15 9	22 16 12 11	19 22 6	19 17 12			1	l	7	13 9 20 11	8 15 9	10 6 12 10 8	12 10 11 6 6	12 12 8 6 9	12 14 10 9	7 8 10 11 14	5 1 6 6 10	1 8 3 5	2 1 3	1	١	2 . 2	3 2	··· ··· 2	1 1 	i	2		.   .	i		:: :							545 489 400 414 286	55 56 57 58 59
6 7 6 7	6 4 7 8	7 6 11 8	13 4 9 6	3 5	12 5 10 5	9 6	8	17 11 12 10 7	7	7 9 15 7 5	11 4 5 5 9	12 3 9 6 6	9 9 10 2	14 6 3 6 4	7 6 8 5 2	8 3 5 1 8	10 5 3 1 6	8 6 4 6 5	1	2 2 3 1 8 6 7 5 4 7	5	3 5 5 5 5 4 5 6 5 6 5 6 5 6 5 6 6 6 6 6 6	3	31223	2 2	$egin{array}{cccc} 2 & \dots & 1 \\ 1 & 1 \\ 2 & 2 \\ 2 & 2 \end{array}$	i 1			i		1						••	347 236 227 229 203	60 61 62 63 64
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:: :: :: 1	:: :: 1 ::	1	1 1 	i	1 4 	1	1	1 2 1	1 1 2 	··· 2 ·i	 3 1	1  i	2 1 1 	3 1 1 	4 1 1 1	$\frac{2}{2}$ $\frac{1}{3}$	 1	1  i	2.	2 1 1	1	1	2 2	 1 1	3 1		3 1	2 1 2 2	2	3 1 1		1 1		i		i.		••	53 33 33 22 23	75 76 77 78 79
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::					::	·i		١	•••	::	•••	•	::	1  	::	::	•••	::	i .							1	::							. i	•• •		i	•••	5 3 3 1 1	85 86 87 88 89
	100		'i			••	::	i		::	:: 1	:::	::				::	••	::			••		· ·		<u> </u>											<u>:::</u>	 54	 1 73	90 95 99 N.S.
1287	1065	948	946	712	063	649	493	481	308	351	238	229	179	189	<b>16</b> 5	159	98	136	58 9	38	<b>6</b> 8	95 5	54	51	43	36 21	21	14	L1 1	.0 4	6	6	4	2 1	3	1.	·  1	111	301918	Total

This table exhibits the various irregularities in the data. The numbers are not quite trustworthy about the ages 21, for reasons which will appear later, as it is certain that in some cases misstatements are made by persons marrying under that age. This table is suitable for the analysis of the frequency at the lower groups of ages only. For the analysis of the frequency at the more advanced age groups, a second table of five-year groups has been prepared. (Table hereinafter).

The frequencies exhibited by this large group of marriages can, without sensible error, be referred to the beginning of the year 1911 (i.e., to 1911.0), as the moment which they can be regarded as true, and from which any secular change may be reckoned, or they may be regarded as contemporaneous with the Census of 3rd April, 1911.

14. Numbers corresponding to given differences of age.—The mode of tabulation in Table LIV., though satisfactory in respect of shewing the grouping according to age-groups for single years, is by no means perfectly satisfactory for the purpose of very accurately determining the frequency of conjugal-groups according to various differences of age. It is obvious that when all bridegrooms, whose age was say x last birthday, and brides whose age was say y last birthday (x and y being integers), are grouped, the group contains brides who are one-half year older than the difference x-y, as well as brides one-half year younger than this difference. can be readily seen from the nature of the table itself. To obtain some rough idea of the defect of such a mode of grouping, we may first divide the numbers (having regard to second differences) into four parts, so as to get the probable numbers attributable to each half of the age-period analysed. These quarter (or half-year) groups, however, will evidently not agree with what would have been given by an original compilation into half-year groups, for the reason indicated above; this will appear more clearly hereinafter.

To properly determine the law of nuptial frequency according to specified differences of age the only perfectly satisfactory compilation would be one in which, for small age-groups of bridegrooms (say) the tabulation was according to a series of increasing age-differences (of the age of the bride), positive and negative, and (for complete analysis) a similar tabulation for small ranges of the age of the brides, with a series of increasing differences, positive and negative, of the age of the bridegroom. These two tabulations would not give identical results, but if the age-groups were small, they would be approximately identical. The data of the table are nevertheless of value, and give a result which is of high precision in regard to the characteristic features of the surface representing the relative frequency of marriages for given pairs of ages.

The results given in Table LIV. are for 301,918 marriages occurring in Australia during eight years, and are drawn from populations (mean annual), which aggregated to nearly 36 millions. The marriage rates were thus as shewn in Table LV., p. 193.

### TABLE LV.-Marriage Rates, Australia, Total Period, 1907-1914.

Males Rates, Males	18,614,557 0.0162195	Females	17,206,457 0.0175468	Persons	35,821,014 0.0168570
-----------------------	-------------------------	---------	-------------------------	---------	-------------------------

These rates may consequently be regarded as representing the probability of a marriage occurring in a population of males, females, or persons, constituted as the average for the eight years, 1907 to 1914, both inclusive, in Australia. The probability of a marriage occurring among the never-married, the widowed, and the divorced, cannot be so well ascertained.

By excluding the unspecified, the probability of marriage for any pair of ages can be ascertained roughly by dividing the numbers in Table LIV. by 301,864; the quotient is the *chance* of the marriage occurring in the group of the pair of ages in question, provided that the proportions to the whole population of the males and females in each group is unchanged. Denoting this probability by  $p_{xy}$ , the marriagerate by  $r_m$ , and the population by P, the number of marriages,  $N_{xy}$ , to be expected of bridegrooms whose age last birthday was x, with brides whose age last birthday was y, is :—

$$(403)...N_{xy} = P r_m p_{xy} ; N_{xy} = P'r'_m p_{xy} ; N_{xy} = P''r'_m p_{xy} ;$$

P,P' and P'' denoting the population of persons, males, and females, respectively; and  $r_m$ ,  $r_m'$  and  $r_m''$  similarly denoting the marriage rates based upon persons, males, or females, respectively. The numbers of the table would roughly give the chance according to "alleged age," not according to "actual age" unless the alleged is also the actual age. We shall proceed to examine this question.

15. Errors in the ages at marriage.—Before analysing the data giving the protogamic surface, it is desirable to determine the error of statement at ages earlier than 21. Here it may be mentioned that the curves of apparent frequency of birth at different ages from say 17 to 22 shew that the numbers are doubtless erroneous. The same fact is suggested by the peculiar irregularities in the numbers graphed in Fig. 60, which shews the numbers of brides and bridegrooms at all ages; see curve A in the figure shewing the result for brides and curve B shewing. that for bridegrooms. The explanation is unquestionably that the group "21 years last birthday" contains a number of persons whose real age was 18, 19 or 20, or possibly even younger than 18. From an investigation of birth-frequency during the seven years, 1908 to 1914, both inclusive, it was found that the numbers given at ages 18 to 21 needed to be multiplied by the factors 1.05701, 1.07918, 1.17022, and 0.82704 respectively. (This applies to females only. There is doubtless also an error for males). Correcting these factors so as to obtain the same totals, the figures in line (4) below are obtained; these are the probable correcting factors to be applied to the

<sup>&</sup>lt;sup>1</sup> The matter is dealt with fully hereinafter,

numbers furnished directly. That is let M' be the true number of marriages for brides of any given age, and let M be the alleged number: then m being the factor of correction, we shall have:—

$$(404)\ldots M' = m M,$$

hence, if the error occur solely through misstatements by persons of 18, 19, 20, and 21 years of age we should have, for each age of bridegroom, to form corrections of the type:—

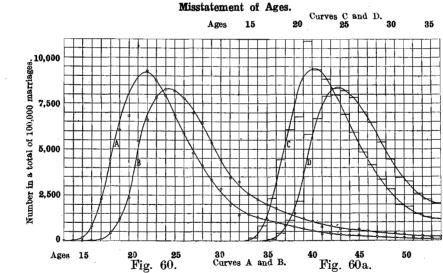
(405)... $(M_{18}^{'}+M_{19}^{'}+M_{20}^{'}+M_{21}^{'})=(m_{18}M_{18}+m_{19}M_{19}+m_{20}M_{20}+m_{21}M_{21})$  This would be the appropriate scheme of correction if corrections for only one sex were needed. The result would then be as follows in Table LVI. hereunder:—

TABLE LVI.—Correction of Numbers of Brides of Alleged Ages, 18 to 21.

Australia, 1908-1914.

	1	1			
(1) Age of Bride	18.	19.	20.	21.	18-21.
(2) Number of Brides	13,246	18,140	20,231	32,673	Total, 84,290
(3) Ratio to Total for		,	•	ŕ	, ,
Ages 18-21	0.1572	0.2152	0.2400	0.3876	Total, 1.0000
(4) Factor of Correction	1.0572	1.0794	1.1704	0.8272	Mean, 1.03355
•					
(5) Product of (3) & (4)	0.16619	0.23229	0.28090	0.32062	Total, 1.00000
(-, (-, (-, (-, (-, (-, (-, (-, (-, (-, (-, (-, (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, -, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, - (-, -))))))))))		000	. 01-000	0.0_0	1

These figures imply that there are 5.72 per cent. more brides of 18, 7.94 per cent. more brides of 19, 17.04 per cent. brides of 20, and 17.28 per cent. less of brides of 21 than admit that they are the ages in question.



The curves A and B denote the number out of a total of 100,000 marriages of brides and bridegrooms respectively; married at given ages. The dots and circles represent the original data, the curves themselves being the smoothed result. Curves C. and D.—The areas of the rectangles shew the numbers of brides and bridegrooms, respectively, married at the given alleged ages. The true numbers are the areas to the curves, which furnish the smoothed results.

<sup>&</sup>lt;sup>1</sup> If in any example the result needed a small correction to balance, it should be made proportional to these last m M-quantities.

An attempt has also been made to ascertain, by smoothing, the probable misstatement on the part of bridegrooms as well as on that of brides. For the sake of comparison the factors for converting the crude data into the smoothed results are given for both bridegrooms and brides, and for males and females from the smoothing of the results of the 1911 Census. The actual smoothing and its effect is shewn on Fig. 60a, see curves C and D, the former being the curve for brides, the latter that for bridegrooms. The areas to the curves give the smoothed results, the areas of the rectangles themselves shew the crude data. In this way the results (1) and (2) are obtained.

TABLE LVII.—Correction-Factors for Males and Females of Alleged Ages, 18 to 21. Australia, 1911.

Factor of Correction for—	How Obtained.	18.	19.	20.	21.
(1) Males	Smoothing of Curve shewing				
	Number of Bridegrooms	1.211	1.137	1.262	0.831
(2) Females	Smoothing of Curve shewing	1	i	İ	
•	Number of Brides	0.962	1.054	1.228	0.844
(3) Females	Smoothing of Fecundity	1	İ		
	Curves	1.0572	1.0794	1.1704	0.827
(4) Females	Mean of (2) and (3)	1.010	1.067	1.199	0.836
(5) Males	Smoothing of Census of				
(-,	Population, 1911	0.9843	1.0273	0.9955	1.028
(6) Females	Smoothing of Census of				.0-0
(-, - 0-140100	Population	0.9924	1.0217	0.9902	1.050

The indications from the smoothing of the number of brides, with those from the smoothing of the fecundity curves (see later) are in substantial agreement, so far as the ages of 19, 20, and 21 are concerned; see lines (2) and (3) in the table above. It will be observed, however, that they are not in agreement with the Census deduction. An agreement was not, however, to be expected in the latter case, for the misstatements occur in regard to the age at marriage, an occasion on which there is not infrequently a motive for the misstatement.

adjustment numbers for ages 18 to 21 inclusive.—The actual adjustment of a table of numbers according to pairs of ages, however, involves the deduction of a number of brides and bridegrooms, which shall be equal for each group. It is evident that, inasmuch as the factors for the two are disparate, different results are obtained if we first correct by the factors for one sex and then by those of the other, or correct independently and take means, etc. For this reason the following method, though not ideally satisfactory, was adopted.

Denoting the correction-factor for bridegrooms (males) of age x by  $m_x$ , and that for brides (females) of age y by  $f_y$ , the composite factor  $(\mu)$ 

<sup>&</sup>lt;sup>1</sup> Chiefly, but not wholly, owing to the attempt, by persons under 21 years of age, to avoid the legal requirements,

for the group of brides and bridegrooms of the respective ages, may be taken as:—

$$(406)\ldots\mu_{xy}=\sqrt{(m_xf_{y'})},$$

that is, it is regarded as the geometric mean of the two. If we decide to make the totals of the groups 18 to 21 unchanged, we shall have to apply a small correction to these factors. Let  $g_{xy}$  denote a group of marriages for the ages in question. If the sum of the products  $\mu g$  be equal to the sum of the original groups, no correction will be required. If it be not equal, then the correction can be distributed in the ratio of the groups themselves. That is,  $\xi$  denoting the correction, the new values (g') of the groups will become:—

$$(407).....g' = g + \xi = g \{1 + (G - \Sigma \mu g) / G\}$$

G denoting the sum of the groups, that is to say,  $G = \Sigma g$ . This method of correcting leaves the entire aggregate unaffected, though it adjusts its component groups. The results are shewn in the table hereunder. The  $\xi$  correction necessary was very small, amounting to only 18 in 17,862. See Table LVIII.

TABLE LVIII.—Correction of Numbers of Marriages for Ages 18, 19, 20, 21.

Australia, 1907 to 1914.

CRUDE RESULTS.					F	'ACTORS	OF COR	CORRECTED RESULTS.							
	18	19	20	21	Totals.	18	3	19 .	20	21	18	19	20	21	Totals
18	309	195	112	78	694	Males Females Means	1.211 1.010 1.1059	1.211 1.067 1.1367	1.211 1.199 1.2049	1.211 0.836 1.0062	343	223	136	79	781
19	778	740	395	327	2,240	Males Females Means	1.137 1.010 <b>1.0716</b>	1.137 1.067 1.1 <b>015</b>	1.137 1.199 1.1676	1.137 0.836 <b>0.9750</b>	837.	819	463	320	2,439
20	1,083	1,261	1,075	891	4,260	Males Females Means	1.262 1.010 1.1290	1.262 1.067 1.1604	1.262 1.199 1.2301	1.262 0.836 1.0271	1,171	1,469	1,328	919	4,887
21	2,076	2,527	2,301	3,764	10,668	Males Females Means	0.831 1.010 <b>0.916</b> 1	0.831 1.067 <b>0.9416</b>	0.831 1.199 <b>0.9982</b>	0.831 0.836 <b>0.8335</b>	1,910	2,389	2,306	3,150	9,755
l'tls	4,196	4,723	3,883	5,060	17,862						4,261	4,900	4,233	4.468	17,862

The effect at the dividing ages of this regrouping is to change the groups  $\frac{2,022}{6,897} \left| \begin{array}{c} 912 \\ 8,031 \end{array} \right|$  into  $\frac{2,222}{6,939} \left| \begin{array}{c} 998 \\ 7,703 \end{array} \right|$ ; hence the five-year groups  $\frac{3,302}{23,130} \left| \begin{array}{c} 1,395 \\ 56,029 \end{array} \right|$  become  $\frac{3,502}{23,172} \left| \begin{array}{c} 1,481 \\ 55,701 \end{array} \right|$ . The totals for brides require that the original figures in Table LIV. should be corrected by + 65, + 177, + 350, and - 592, and the totals for bridegrooms corrected by + 87, + 199, + 627 and - 913.

TABLE LIX.—Shewing the Number per 100,000 Bridegrooms, and per 100,000 Brides Married at Given Ages. Australia, 1907-1914.†

	Crude I	Results.	Adjusted	Results.		Crude	Results.	Adjusted	Results.
Age.	Bride- grooms.	Brides.	Bride- grooms.	Brides.	Age.	Bride- grooms.	Brides.	Bride- grooms.	Brides.
(i.)	(ii.)	(iii.)	(iv.)	(v.)	(i.)	(ii.)	(iji.)	(iv.)	(v.)
12 13 14		$\begin{array}{c}1\\1\\24\end{array}$	$0.0 \\ 0.1 \\ 0.2$	$0.5 \\ 1.5 \\ 24$	55 56 57	181 162 133	59 63 55	184 167 151	72 66 60
12-14		26	0.3	26	58 59	137 95	53 32	136 122	54 48
15 16 17	1 17 79	162 799 2,288	0.8 16.9 79	162 799 2,288	55-59	708	262	760	300
18 19	428* 1,176*	4,409* 6,067*	428 1,176	4,409 6,600	$\begin{array}{ccc} 60 & \dots \\ 61 & \dots \\ 62 & \dots \end{array}$	115 78 75	45 19 31	109 97 86	42 36 31
15-19	1,701	13,725	1,700.7	14,253	63 64	76 67	27 23	76 68	27 24
$\begin{array}{cccc} 20 & \dots \\ 21 & \dots \\ 22 & \dots \end{array}$	2,340* 5,452* 6,615	6,817* 10,626* 9,257	2,542 4,997 6,868	8,020 8,920 9,200 8,745	60-64	411	178	436	160
23 24	7,834 8,253	8,745 7,917	7,834 8,253	7,917	65 66 67	73 56 54	32 19 18	60.0 53.0 47.0	21.8 19.5 17.1
20-24	30,940	43,362	30,494	42,802	68 69	51 41	17 <b>14</b>	42.0 37.5	15.0 $12.6$
25 26 27	6.960	6,858 5,873 4,783	8,190 7,782 7,120	6,819 5,843 4,897	65-69	275	100	239.5	86.0
28 29	5,337	4,098 3,315	6,290 5,337	4,078 3,297	$\begin{array}{ccc} 70 & \dots \\ 71 & \dots \\ 72 & \dots \end{array}$	23 23	19 7 7	34.0 31.0 28.0	10.6 8.5 6.7
25-29	<del></del>	24,927	34,719	24,934	$73 \cdots 74 \cdots$	26 21	5 4	25.0 21.5	5.1 3.6
30 31 32	1 0 000	2,784 1,937 1,841	4,383 3,603 3,003	2,670 2,155 1,760	70–74	137	35	139.5	34.6
33 34	2,554	1,438 1,277	2,603 2,278	1,470 1,260	75 76 77	17 11 11	3 1 2	17.2 13.6 10.9	2.8 2.1 1.6
30–34	1	9,277	15,870	9,315	78 79	7 7	2 1	8.7 7.0	1.5
35 3 <b>6</b> 37	1,770	1,166 968 808	1,995 1,748 1,533	1,143 1,003 873	75–79	53	9	57.4	8.0
38 39	1,501	785 664	1,346	753 643	80 81 82	3 3	1 0 1	5.6 4.5 3.6	0.' 0.' 0.
35-39		4,391	7,805	4,415	83 · · · 84 · ·		0	2.9 2.3	0. 0.
40 . 41 . 42 .	774 807	560 373 426	1,040 912 800	547 465 397	80-84	20	2	18.9	2.
43 .	. 580	353 314	713 649	343 303	85 86		O	1.8 1.4	0. 0.
40-44 . 45 .	010	313	589	$\frac{2,055}{271}$	87 88 89	. 0	0 0	1.0 0.6 0.3	0. 0. 0.
46 . 47 .	. 522	236 220	527 468	241 213	85-89	4	0	5.15	0.
48 49	. 452	215 163	413 363	187 163	90	. 0.	0	0.25 0.15	"
45-49	2,413	1,147	2,360	1,075	92 . 93 .	: 0	0	0.1 0.05	
50 . 51 . 52 .	. 248 . 263	159 102 116	319 282 251	138 118 102	94 . 90–94 .		0	0.0	
53 . 54 .		79 76	225 203	90 80	Unspeci-				
50-54 .	. 1,300	532	1,280	528	fled .	. 24	37	Nil .	Nil

<sup>\*</sup> These have been partially corrected for misstatement of age. † See Section 17, hereinafter, for description of Table.

17. Probability of marriage of bride or bridegroom of a given age, to a bridegroom or bride of any (unspecified) age.—The correction of the data, as indicated in the preceding section, admits of the construction of a table shewing in say 100,000 marriages the number occurring for bridegrooms of any given ages, and for brides of any given ages, the age of the other partner to the union being unspecified. In columns (ii.) and (iii.) of Table LIX., hereinbefore, the data are given the corrections referred to having been applied: columns (iv.) and (v.) are the smoothed results. The original data are shewn by dots on Fig. 60, the smoothed results by the curve, the ordinates to which represent throughout the probability of a marriage occurring within one half-year either side of any given age: that is, they are the values of the integrals:—

$$K \int_{x-\frac{1}{2}}^{x+\frac{1}{4}} x \quad \text{and} \quad K' \int_{y-\frac{1}{4}}^{y+\frac{1}{4}} y ;$$

see section 19 hereinafter.

18. Tabulation in 5-year groups.—So small a number as 300,000 does not give sufficient data for the determination of the averages for single years, at the higher ages. Before 25 is reached over one-fourth of the marriages have been consummated, and before 30, over two-thirds (exactly 0.277921, and 0.691744 respectively). This leaves for groups of over 30 years of age only about 93,069 among 6500 groups or an average of about 14 per group. It is thus necessary to form 5-year groups. These are shewn in Table LX. hereunder. The corrections, referred to in last section, change these numbers as follows:—

١.	JUSTED DATA	Aı	ORIGINAL DATA.						
5,138 92.068	1,481 55,701	3,502 23,172	4,852 92,354	1, <b>3</b> 95 56,029	3,302 23,130				
Totals.	130,909	41,135	Totals.	13,1151	41.193				

The numbers given in the table itself are the uncorrected data. It will be seen that they are still small for the higher ages. To determine the critical features of the surface representing the frequency of marriage both Tables LIV. and LX. are required. Were these two tables smoothed they would give the probabilities of a marriage occurring within the year groups of specified ages or specified quinquennia. None of the groups is perfectly regular, but the greater regularity of the larger groups exists only for a limited range of years. The matter will be dealt with more fully hereinafter, viz., in § 23.

TABLE LX.—Number of Marriages Arranged According to Age at Marriage in Five Year Groups. Australia, 1907-14.

										,							
						Br	ides' A	ges.									Ratio
Bride- grooms' Ages.	10 to 14.	to	20 to 24.†	25 to 29.	30 to 34.	35 to 39.	40 to 44.	45 to 49.	50 to 54.	55 to 59.	60 to 64.	65 to 69.	70 to 74.	75 to 79.	80 to 84.	Total,* 10 to 84,	Bride grooms to Total.
15-19† 20-24† 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85-90	9 44 18 13 11 22	23,130 10,637 2,795 917 237	156,029 150,597 15,513 5,134 1,576 598 183 73	11,302 34,896 117,366 1 7,298 2,564 1,077 384 129 71 24	1,437 6,739 9,130 5,672	325 1,369 2,476 3,621 2,473 11,653	1,038 1,502 1,279 1,754 360 162 80 50	22 78 146 1313 510 859 675 1 445	26 65 112 263 <b>406</b> 289 1 208	15 26 74 117 <b>218</b> 144 113 41	8 36 37 65 <b>106</b> 105 50	1 2 1 8 20 26 60 97 59 21 4	  2 4 16 19 28 25 1 8	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	4,852 92,354 104,639 47,983 24,080 11,821 7,277 3,926 2,132 1,242 826 415 164 62	1,608 30,602 34,673 16,900 7,979 3,917 2,411 1,301 706 412 274 138 54 21
Total*	78	41,193	131,151	75,257	28,003	13,257	6,114	3,462	1,605	790	435	300	103	30	7	301,785	100,000
Ratio of Brides to Total	26	13,650	43,459	24,937	9,279	4,393	2,026	1,147	532	262	144	99	34	10	2	100,000	.331 <b>3617</b>

<sup>\*</sup> Brides over 85 and bridegrooms over 95, and unspecified cases are omitted. The heavy faced type denotes the maximum on the vertical lines; the mark of exclamation (!) denotes the maximum on the horizontal lines.

19. Frequency of marriage according to age representable by a system of curved lines.—Frequency according to pairs of ages (bride and bridegroom) can best be represented by a surface, the vertical height of which, above a reference plane, is the frequency for any pair of ages denoted by x, y co-ordinates. The numbers marrying in any given period, whose ages range between  $x - \frac{1}{2}k$  and  $x + \frac{1}{2}k$  (for bridegrooms), and between  $y - \frac{1}{2}k$  and  $y + \frac{1}{2}k$  (for brides), as ordinarily furnished by the data, are denoted by Z, the height of the parallelepiped. This frequency may, of course, be expressed as for the exact age, or it may be for the age-groups. When k is not infinitesimally small, the difference between the two is sensible and important. We shall assume for the present that the frequency varies only with age (not with time). The exact (instantaneous) age-frequency denotes the frequency which would exist if the persons were all of the exact age (x) in question, instead of being of various ages between  $x - \frac{1}{2} k$  and  $x + \frac{1}{2} k$ . The age-group frequency denotes the frequency with the ages distributed between the limits referred to. For most practical purposes the latter is the more important. Suppose the exact frequency, z, for the population P, to be :—

$$(408)\ldots \frac{z}{P} = F(x,y)$$

then we shall have for any group-value :-

$$(409)\ldots Z = P \int \int F(x,y) dx dy$$

horizontal lines.

† The values corrected for misstatement of ages, 18, 19, 20, and 21 give the following results:—For 3,302 and 1,385, 3,502 and 1,481; and for 23,130 and 56,029, 23,172 and 55,701. In the totals 41,193 and 131,151 become 41,435 and 130,909; and 4,852, and 92,354 become 5,138 and 92,068, and 43,459 become 13,730 and 43,378; and 1,608 and 30,602 become 1,703 and 30,508.

‡ Factor of reduction to 100,000.

The group-values usually furnished are for single-year groups, hence the limits of the integral are  $x \pm \frac{1}{2}$ ,  $y \pm \frac{1}{2}$ . It may sometimes be more convenient to use a series of functions of the form:—

$$(410).....\frac{Z}{P} = F_{Y}(x); \text{ or } F_{X}(y)$$

in which case the fixed value of Y or of X will be the middle of the range  $y \pm \frac{1}{2}$ , or  $x \pm \frac{1}{2}$ . Then we shall have :—

$$(411)\ldots Z = P \int F_{X}(x) dx; \text{ or } = P \int F_{X}(y) dy$$

These last expressions, with fixed values either of Y or of X, are thus appropriate for representing the vertical or horizontal columns of figures in Tables LIV. and LX. by means of equations. For the vertical columns the abscissa is x, the age of the bridegrooms; for the horizontal columns the abscissa is y, the age of the brides; and the constants of the equations relate only to a particular range of y in the first case, and of x in the second, as many equations being required as there are ranges taken. We consider the matter more fully in a later section. This scheme of representation is practically more convenient than a more generalised system, it shews for each age of bridegroom (or of bride) the frequency of marriage with a bride (or a bridegroom) of a given age. (See part V., § 10, formulæ 211 to 216.)

20. The error of adopting a middle value of a range.—In dealing with group-ranges, in the manner referred to in the preceding section, the results are not strictly attributable to the middle age of the range, nor is the error of such an attribution by any means always wholly negligible. The function represents the value of a range of values of the argument, i.e., for example, all bridegrooms whose age last birthday was x, x being an integer, or the group of bridegrooms whose age last birthday was say, between 20 and 24, etc. Suppose, for example, that the progression of a series of numbers, representing numbers at successive ages is approximately:—

$$(412)...y = a + mx$$
; so that  $xy = ax + mx^2$ ;

then the true value of the product of the numbers into the ages is given by the integral:—

$$(413)....\int_{x}^{x+1} xy \, dx = a \, (x + \frac{1}{2}) + m \, (x^{2} + x + \frac{1}{3})$$

Consequently where we require the weighted mean-age, it is necessary to compare this value with that arising from the supposition that all may be regarded as of age  $x + \frac{1}{2}$ . If we make this last assumption, then we should have for the product of the numbers into the age, supposed common to all,

$$(414)...a (x + \frac{1}{2}) + m (x^2 + x + \frac{1}{4}).$$

The former expression is algebraically greater than this latter one by the difference of m/3 and m/4, that is m/12, which is sensibly equivalent to a

shift  $(\epsilon)$  of the central position of the amount m/12y. Thus, instead of the central value of the range of ages we should take the "weighted mean" xa, which is given by :—

$$(415)....x_a = x + \frac{1}{2} + \epsilon = x + \frac{1}{2} + \frac{m}{12u}$$

In applying this we may take m as indicated by the mean of the differences of the groups adjoining on either side. Thus if the groups for the ages 20 (and less than 21), 21, and 22 were respectively 76,132, and 224, then, instead of taking 21.5 as the mean age-value, i.e., the middle age of the range 21 (which include everyone whose age last birthday was 21), we could take m as the mean of 132-76 and 224-132, that is,  $m = \frac{1}{2} (56 + 92)$ ; or, as is obvious,  $\frac{1}{2} (224-76)$ , i.e., 74. Consequently by the rule above, viz. (415), we have  $x_a = 21.5+74 / (12 \times 132) = 21.54671$ .

A curve which would give the group-results indicated is  $60 + 20\xi + 18\xi^2$ , the origin of abscisse being x = 20, so that  $\xi = 1$  for x = 21, and so on. The integral of the curve is  $60\xi + 10\xi^2 + 6\xi^3$ . If we put  $\xi = x - 20$  we obtain the curve  $y = 6860 - 700 x + 18x^2$  with the origin at x = 0, hence the integral between the limits x = 21 and x = 22 is  $3430 x^2 - 233\frac{1}{3} x^3 + 4\frac{1}{2} x^4$ , which gives the result  $2844\frac{1}{6}$  as the sum of the xy products. Dividing this by 132, the number in the group, the average age is found to be 21.54671 as before. Let three successive groups for equal ranges of the variable be denoted by A, M, and B; and let  $x_m$  be the middle point on the range of abscisse of the middle group, M; then the mean value required (i.e., in the case under review, the average age of the persons in the group) is:—

$$(416)....x_a = x_m + \frac{1}{24} k \frac{B - A}{M}$$

in which k is the range of the variable common to the three groups. If the curve of instantaneous values be of the second degree, this last formula is rigorously accurate. By means of it, the average values can, as a rule, be written in by inspection, and it can be ascertained where the correction  $\epsilon = \frac{1}{24} k \ (B-A) \ / \ M$  is sufficiently large to be taken into account.

21. General theory of protogamic and gamic surfaces.—The ages of husbands being adopted as abscissæ, and those of wives as ordinates, the infinitesimal number dM in an infinitesimal group of married couples, consisting of husbands, whose ages lie between x and x + dx, and their wives, whose ages lie between y and y + dy, will be:—

$$(417)....dM = Z dx dy = kF(x, y) dx dy.$$

Thus Z = k F(x, y) is representable by a co-ordinate vertical to the xy plane. Since Z denotes an actual number of persons in a double age-group, between say the earliest age of marriage and the end of life, viz.,  $(x_1 \text{ to } x_2)$  and  $(y_1 \text{ to } y_2)$ , it is necessary, if we desire to institute comparisons between different populations, that Z should be expressed as a rate, z say: that is, z = either Z/P; or Z/M; that is to say, the

vertical height will represent the relative frequency of married couples whose ages are, in the order of husband and wife, x and y, in either the whole population P, or the married portion of it M. Thus we shall have

(418).... 
$$P$$
, or  $M = k \int \int F(x, y) dx dy$ .

If the value of the double integral be taken for the limits denoting the range of ages of the married, say about 11 to 105, we shall have either M/P, or unity, as the result; according as we denote by the frequency in reference to the total population or to the total married.

Thus the marital or gamic condition of a community is completely specified by the gamic surface F(x, y, z), the unique mode of which is the summit of the conoidal solid represented by (418) above. Its first principal meridian is the line joining the modes of the curves x=a constant, or y=a constant, passing therefore through the unique mode. The curves, z=any constant less than its maximum value, are necessarily closed curves, and may be called isogamic contours. The orthogonal trajectory passing through the unique mode is the second principal meridian of the surface. The values of x, y, and z for the unique mode of the surface may be called the gamic mode of the "population," or of the "married population," according as the constant k, in (418) above, gives M/P, or unity for the value of the double integral between the widest age limits.

The gamic characteristics of a population are more briefly, and of course less completely, defined by the two principal meridians which we may call its gamic meridians, and the position (and magnitude) of the gamic mode. Reducing these to their simplest numerical expression we have, for the briefest possible statement of the gamic characteristics of any community the values of  $x_m$ ,  $y_m$ , and  $z_m$ ; and of the skewness of the profiles of the first and second principal meridians. The sign of the skewness may be determined by always making the right hand branch of the curve that for increasing age for the first principal meridian, and increasing age of the husband for the second principal meridian.

A surface representing the frequency of marriage at particular pairs of ages we shall call a *protogamic surface*, and one representing the number of persons of particular pairs of ages living together in the state of marriage we shall call simply a *gamic surface*.

Curves of equal frequency on these two surfaces, we shall call isoprotogamic and isogamic contours, respectively, or more briefly, isoprotogams and isogams, and curves cutting such contours orthogonally will be called protogamic and gamic meridians.<sup>1</sup>

Let s denote a distance measured along a slope, so that ds is an element thereof. Then when—

$$(419)....dz/ds = \sin \zeta$$

<sup>&</sup>lt;sup>1</sup> The word "isogamy" has already been appropriated in a different sense in biology, viz., to denote the union of two equal and similar "gametes" in reproduction. This, however, will obviously lead to no confusion. The isogamy of a people might be regarded as of two kinds, initial or nuptial isogamy (isoprotogamy), and characteristic or marital isogamy (or simply isogamy).

= a maximum or a minimum, the element ds is an element of a meridian; such meridians are the *principal meridians* above referred to; *i.e.*, the principal meridians are the *lines of greatest and least slope*.

22. Orthogonal Trajectories.—The general theory of orthogonal trajectories may be stated as follows:—Let the co-ordinates of a system of curves (isogams or equal marriage frequency in the case considered) be denoted by x and y, and those of the trajectory, cutting the system orthogonally, by  $\xi$  and  $\eta$ ; then, although for any point of intersection of the two  $x = \xi$  and  $y = \eta$ , dy/dx is not the same as  $d\eta/d\xi$ . Since the tangents to the two curves are at right angles, we have the geometric relation  $dy/dx = -d\xi/d\eta$  or

$$(420)\dots 1 + \frac{dy}{dx} \cdot \frac{d\eta}{d\xi} = 0$$

For any system of curves we have then

$$(421)...f(x, y, a) = 0;$$

where a is a constant; then, employing  $\delta/\delta x$  and  $\delta/\delta y$  to denote partial differentiation with respect to x and y, we have also

$$(422)\ldots \frac{\delta f}{\delta x} + \frac{\delta f}{\delta y} \cdot \frac{dy}{dx} = 0,$$

an equation by means of which a may be eliminated, so that a relation may be obtained between x, y and dy/dx. Let this relation be denoted by :—

$$(423)\ldots\ldots\psi(x, y, \frac{dy}{dx})=0$$

This last expression is the differential equation of the system of curves we require.

For orthogonal trajectories we have  $\xi = x$ ,  $\eta = y$  and  $dy/dx = -1/(d\eta/d\xi)$ , hence the differential equation of the system of orthogonal trajectories is:—

$$(424)\ldots \psi (\xi, \eta, -\frac{1}{\frac{d\eta}{d\xi}}) = 0$$

In the system we are considering, the curves (isogams) do not conform to any simple specification, hence the present imperfect data do not indicate any unique system of curves of a simple character. If they did, it would be preferable to deduce the principal meridians of the surface by means of the general equation thereto. An examination of the surface, however, shews that there is no practical advantage in attempting to express it analytically.

23. Critical characters on the protogamic surface.—A review of the figures in Tables LIV. and LX. reveals the fact that, in general, if we regard the numbers of marriages corresponding to any given age for brides (the columns), there is a clearly-defined maximum value; but that if we regard those corresponding to any given ages for bridegrooms (the rows), there are in many cases two or even three maximum values.

In this latter case, too, the maximum is often less clearly defined. The positions of these maximum points and the numbers (frequency) corresponding thereto, are important, as they disclose the characteristics of the surface. There are two ways of estimating the position and frequency at the maximum (or any other point). One is to ascertain the position and frequency for the maximum of the frequency integral taken over the range  $x-\frac{1}{2}$  to  $x+\frac{1}{2}$ , or over the range  $y-\frac{1}{2}$  to  $y+\frac{1}{2}$ ; the other is to determine those elements for the maximum instantaneous frequency; that is to ascertain the point when the frequency for an indefinitely small range is a maximum (expressed, however, per unit of age-difference, say one year). The latter only will be ascertained.

By applying formulæ (292) to (294), see Part VII., § 11, p. 92, the position and value of these maximum points (viz., those on the surface for ages of brides constant that of bridegrooms being variable, or for ages of husbands constant and that of brides variable), may be obtained. In this way the results given in the two following tables are deduced, viz., Tables LXI., and LXII., and in connection therewith it is to be remarked (a) that for results of high precision, the quinquennial grouping can be used only for the small groups at higher ages; and (b) that the grouping in fives, not only tends to obliterate characteristics readily discernible in year-groupings, but gives a frequency of the order of about 25 times the magnitude of those groupings. Thus for very young ages and for the older age-pairs, the large grouping gives the best indication.<sup>1</sup>

¹ The values are obtained in the following way:—The position of the maximum of one group (say of bridegrooms) corresponding to the range of another group (say of brides) is found from the succession of the group-totals of the first, for any one range of the second, and is attributed to a mean age of the second, computed from the progression of numbers in the series of group totals of the second. By way of illustration consider the group of 59, for the age-group 65-69 of brides, and 70 to 74 of bridegrooms; viz., the following figures:—

Instances in Group.	Adjoining Group Totals.
	60
3.4.1.1.2	105.97.19
2.1.1.2.2	
4.2.0.3.2	41.50.59.28.6
7.3.2.5.3	
3.0.0.2.4	14.21.25
	4

The surrounding group-totals are as shewn. If the ages of brides be taken as at the middle of the years, i.e., as  $65\frac{1}{2}$ ,  $66\frac{1}{2}$ , etc., and of the bridegrooms as  $70\frac{1}{2}$ ,  $71\frac{1}{2}$ , etc., the actual weighted-mean ages (deduced from the indivividual numbers) are as shewn hereunder. Slightly different results are obtained if the ages are deduced from the vertical and horizontal columns, viz., 97, 59, 21; 50, 59, 28; and from the diagonal totals, viz., 105, 59, 25; and 19, 59, 14. These different results are for bride and bridegroom respectively:—

	Middle of Gi	Values roups.	Actual V Group	Veighted means.	Compute Vertical et	Groups,	Computed from Diagonal Groups.			
Years	67.5	72.5	67.35	72.64	67.48	72.45	67.46	72.40		

This series of results shows that the error of assuming that the entire group is representable by the middle ages is not ordinarily considerable.

TABLE LXI.—Critical Positions on the Protogamic Surface for Year-groups.

Marriages in Australia, 1907-1914. (Greatest frequency for various combinations of Age at Marriage).

Mean Age of Brides in Maximum Group.	Age of Bride- groom for Maximum Frequency.	Difference of Age.	Maximum Frequency.	Proportion of All Brides of same Age-Group.
13.5	21.2	7.7	1	0.250
14.7	22.4	7.7	17	0.233
15.7	21.6	5.9	69	0.141
16.6	21.6	5.0	372	.1504
17.6	21.7	4.1	1203	.1742
18.5	21.7	3.2	2164	.1621
10.0			1986‡	.1492
19.5	21.9	2.4	2600	.1434
10.0	21.8	2.5	2500‡	.1364
20.5	23.4	2.9	2573	.1272
20.0	20.1	2.0	2010	.1256
21,5	23.3	1.8	4156	.1266
21.0	20.0	1.0	1100	.1295
22,5	23.7	1.2	3511	.1256
23.5	24.3	1.2	3269	.1239
24.5	24.6	0.1	3040	.1272
25.5	25.7	0.2	2744	.1325
26.5	26.6	0.1	$\begin{array}{c} 2744 \\ 2247 \end{array}$	.1276
$\frac{20.5}{27.5}$	27.7	0.1 $0.2$	1753	.1214
28.5	28.5	0.0	1328	.1073
29.5	29.5	0.0	1045	.1046
30.5	30.7	0.0	768	.0913
31.5	31.6	0.1	565	.0966
$\begin{array}{c} 31.5 \\ 32.5 \end{array}$	32.5	0.0	510	.0916
32.5 33.5	33.5	0.0	320	.0737
33.5 34.5	34.6	0.0	305	.0791
35.5	35.5	0.0	236	.0670
36.5	36.5	0.0	190	.0650
30.5 37.5	37.9	0.4	167	.0685
38.5	38.6	0.1	194	.0801
39.5	39.5	0.0	153	.0765
39.5 40.5	40.3	<b>—0.0</b>	133 121	.0717
$\begin{array}{c} 40.5 \\ 41.5 \end{array}$	41.2	$-0.2 \\ -0.3$	74	.0657
$\begin{array}{c} \textbf{41.5} \\ \textbf{42.5} \end{array}$	43,1	$-0.3 \\ +0.6$	94	.0730
$\begin{array}{c} 42.5 \\ 43.5 \end{array}$	45.2	$^{+0.6}_{+1.7}$	80	.07512
	45.2	$^{+1.7}_{+0.8}$	63	.0664
44.5	40.0	+0.0	บอ	.0004

In determining any critical point, however, the ages deduced as shewn above are not what is required. What is definitely sought is the position and value of the maximum frequency, referred to a mean age of bridegrooms (x), (or of brides (y)); that is the value of y (or of x, respectively) at which the maximum value occurs. The data from which these are deduced are the series of parallelepipeds the heights of which may be taken as the group-totals. Thus, the horizontal series of group-numbers 50, 59 and 28, treated as ordinate-values bounded by a curve, gives 66.13 years as the age of brides, corresponding to a maximum frequency of 62.18. If the 41 group be included, the maximum will be changed to age 67.50 years, and the frequency to 60.29. The mean age of the bridegrooms should be ascertained on the vertical line 67.50 for brides, but without incurring sensible error it may be taken as 72.50-5 (97-21)  $\rightarrow$  ( $24 \times 59$ )  $\rightarrow$  72.23, see this part, section 20, formulæ (412) to (415); the factor 5, however, appearing because the unit is 5-years. Respecting the computation of the critical positions, it may be mentioned that the curve is found to be  $y=44\frac{1}{4}-19\frac{x}{12} \times 23\frac{1}{4} \times 2-5\frac{1}{6} \times 3$ , the origin of X being at age 55.00, and the unit of X being 5 years. This gives  $x^2-3x+\frac{3}{4}=\frac{3}{3}\frac{7}{12}=$  say 1. Hence (with sufficient approximation)  $X_m=\frac{1}{2}$  and  $\frac{1}{2}$  or in years five times these amounts, or  $2\frac{1}{2}$  and  $12\frac{1}{2}$ . This gives  $39\frac{1}{2}\frac{7}{4}$  and  $60\frac{7}{24}$  as the frequencies at the maximum and minimum.

Mean Age of Bridegrooms in Maximum Group.	Age of Bride for Maximum Frequency.	Difference of Age.	Maximum Frequency.	Proportion of all Bridegrooms of same Age-Group.
15.5	16.5	1.0	1	0.250
16.5	17.5	1.0	14	.274
17.5	17.7	0.2	60	.250
18.5	18.4	-0.1	318	.264
_	18.5‡	0.0	352‡	.272‡
19.5	18.9	-0.6	820	.2416
			897‡	.2554‡
20.5	19.5	1.0	1279	.1986
. 01 5	10.5		1496‡	.2117‡
21.5	19.7	-1.8	2558	.1472
21.5	19.7‡	-1.8‡	2410‡	.1465‡
21.5 22.5	21.4‡ 21.6	-0.1‡	3250‡ 4110	.1968‡
44.0	21.8 21.8	$ \begin{array}{c c} -0.9 \\ -0.7 \end{array} $	3424	.2057 $.1714$
23.5	21.7	—0.7 —1.8	4250	.1839
20.0	22.1‡	—1.4±	3508‡	.1000
<b>2</b> 4.5	21.8	-2.7	3766	.1511
	22.81	— <u>1.7</u> ±	3333‡	
25.5	$21.5\S$	-4.0 §	3276	.1329 §
	23.3‡	-2.21	3026‡	$.1225 \overset{3}{1}$
	21.9	<b>—3.6</b>	3342	•
<b>26.5</b>	21.6§	—4.9 §	2710§	.1158
	23.4‡	3.0‡	2694‡	.1147‡
2	21.9	-4.6	2774	
27.5	22.6	-4.9	2271	.1080
	20.6	6.9	2230	.1061
28.5	21.8	5.7	2293	1100
28.0	24.3 21.9	-4.2 -6.6	1977	.1199
29.5	24.7		1973 1492	.0932
20.0	22.0	—4.6 —7.5	1458	.0002
30.5	26.0	-4.5	1195	.0892
	21.9	8.6	1080	10002
31.5	26.2	5.3	849	.0820
32.5	26.1	-6.4	809	.0830
	22.7	9.8	719	
33.5	26.3	<b>—7.2</b>	565	.0733
0.4 5	23.4	-10.1	557	.0722
34.5	24.5 34.2?	-10.0	560	.0823
35.5	25.5	-0.3? $-10.0$	309? 486	.0455?
36.5	26.5	10.0 10.0	371	.0800
37.5	27.4	-10.0 -10.1	332	.0753
0110	37.2	- 0.3	171	.0388
38.5	28.5	-10.0	364	.0804
	38.3	- 0.2	195	.0430
39.5	29.5	-10.0	246	.0658
	39.2	0.3	157	.0420
40.5	30.3	10.2	217	.0667
41.5	31.5	10.0	144	.0617
40 ~	41.2	0.3	76	.0325
42.5	32.5	-10.0	137	.0562
. 49 #	42.3	-0.2	90	.0361
43.5	32 9 42.9	-10.6	108	.0525
44.5	32.7	-0.6 $-11.8$	94 99	.0457
TT.U		—11.6 — 1.0		
	43.5	- 1.0	57	.0326

<sup>‡</sup> The results include corrections for misstatements of age. § These maxima disappear altogether when corrections are applied for misstatements of age.

TABLE LXII.—Critical Positions on the Protogamic Surface, for 5-Year Groups.

Marriages in Australia, 1907-1914.

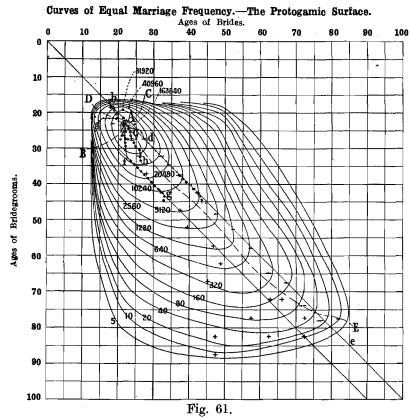
	_	<u> </u>	1	- <del>i</del>				
Maximum age-group of bridge	10-14	15–19	20-24	25-2	29 30-	-34 3	5-39	40-44
Mean age of brides in maximum group	*14.3	*18.3 ?	*21.6 22.5			2.2 2.1	? 37.2	? 42.2
Age of bridegroom for maximum frequency Difference of age	22.9 8.6	23.1 4.8	†23.8 2.2	0.	.9   -	2.1 0.1	37.5 0.3	43.4 1.2
Maximum frequency	46.7	24685 124727	1.3 †72500 ‡72170	3672		7.6 37	716.5	1541.1
Proportion of all brides of same age-group	0.600	0.599 ‡0.601	0.553 ‡0.551		38 0.:	336	0.280	0.251
Maximum age-group of bridegrooms Mean age bridegrooms in maximum group	15–19 *18.4	20-24	25–29 27.3	""		-39 4 87.1	0-44	45-49 47.3
Age of bride for maximum frequency Difference of age Maximum frequency	17.8 0.6 3800 14000	22.1 0.2 59496 159166	23.6 3.7 51865	25	.9 2	27.9 9.2	32.1 10.1 337.0	37.4 9.9 1683.8
Proportion of all bride- grooms of same age- group	0.783 0.779	0.644 0.643	0.496	0.38	31 0.	310	0.240	0.231
Maximum age-group of brides	45-49	50-54	55-59	60–64	65-69	70-74	75-79	80-84
Mean age of brides in maximum group	? 47.3	? 52.2	? 57.3	? 62.3	*67.3 67.3	*71.5 72.1	*76.50 76.8	*81.8 82.2
Age of bridegroom for maximum frequency Difference of age	48.3 1.05	52.7 0.5	57.9 0.6	64.9 2.6	67.5 0.2 0.2	73.7 2.2 1.6	78.0 1.5 1.2	77.5 -4.3 -4.7
Maximum frequency Proportion of all brides	887.5	417.1	225.8	111.0	100.1	28.5	8.3	4.3
of some age-group  Maximum age-group of	0.254	0.260	0.286	0.255	0.334	0.277	0.280	0.610
bridegrooms Mean age bridegrooms lu maximum group	50-54 52.1	55-5 <b>9</b> 57.3	60–64 62,3	65-5 <b>9</b> 67.3	70-74	75–79 77.3	80-84 82.4	8589 87.4
Age of bride for maxi-				<del></del>			1	
mum frequency	39.6	<b>46.</b> 8	48.8	45.2	62.8 66.1	57.5 72.5	47.4 62.5 72.5	47.5
Difference of age	12.5	10.5	13.5	22.1	9.4 6.1	3	?	?
Maximum frequency	785.5	457.9	213.9	139.0	66.6 62.2	32.3 .25.9	10.2 9.6 8.7	4.3
Proportion of all bride- grooms of same age- group	0.200	0.215	0.172	0.168	0.160 0.150	0.197 0.158	0.165 0.155 0.140	0.360

<sup>\*</sup> Calculated from yearly group results. † It is impossible from the data to determine these values with precision. ‡ With partial corrections for misstatements of age.

Fig. 61 shews the graphs of the maximum values. It is evident from these graphs that the greatest frequency of marriage is not well-defined according to alleged ages. The surface shews ridges on the lines Aa, Ab, Acde, Afg and Ah. The highest point is for the group bridegrooms about 23.4, and brides 21.6 years of age, the frequency attaining to about 4,200, or about one seventy-second part (0.013911) of all the marriages.

The maximum group is 4114, or 0.13626 of the marriages. These figures are, however, somewhat uncertain, for reasons which will be pointed out in the next section.

- 24. Apparent peculiarities of the protogamic frequency.—Fig. 61 shews, by dots, the positions of maxima on the (vertical) columns, that is according to the ages of brides; and, by dots with circles, the positions of the maxima on the (horizontal) rows, that is according to the ages of bridegrooms. If the ages have been correctly given there is no unique mode on the horizontal lines; and this is a matter which demands special consideration. In Part X., § 6, Fig. 42, p. 115, it is shewn that the number of under-statements by women amounting to 10 years, is quite abnormal; it does not follow the progressive diminution which characterises understatements amounting from 1 to 11 years. In the figure the line bAde would be the characteristic summit if the greatest frequency of marriage was in the case of parties of the same age. The line f g would be the characteristic if a large number of men married wives 10 years younger than themselves; while for the line Af to hold good, very large numbers of men of ages 22 to 31 must marry women of 21 years of age, irrespective of the disparity of age. To give the line of maxima Ah, a considerable number of men must marry women whose difference of age is one-half their age above 22. Such characters in a protogamic surface, are, a priori, extremely improbable. They would also characterise the apparent protogamic surface, if a considerable number of women, really of ages 22 to 32, all gave their ages as 22, when marrying men of from 22 to 32 years of age, and if a considerable number of women of 32 and upwards understated their ages by 10 years. This explanation probably does not differ very materially from the fact. Hence Tables LIV and LX must be regarded as of inferior value. It is, of course, much to be regretted that social organisation does not admit of the socialpsychological fact of conjugal frequency at equal and disparate ages being accurately ascertained.
- 25. The contours of the protogamic surface.—The tedium of a rigorous analysis of a surface, when the measure of uncertainty is so large as is the case with the protogamic surface for Australia, is not warranted. A rough smoothing of the 5-year groups was, therefore, effected, and attributing the smoothed values to the centre points of the groups, and a series of contours for the proportions of 5, 10, 20, 40, etc., in a million of total marriages of all ages, were inserted by graphic methods. These gave fairly smooth contours. Regular curves being drawn, so as to ignore the minute undulations of the contours the results shewn on Fig. 61 are obtained. These represent with considerable precision the actual data from which they were derived, and will enable such data to be reproduced. They disclose the frequency distribution, for all combinations of ages.



Note.—The pairs of ages which give equal frequency of marriage are found by following the course of any isoprotogam. The frequency indicated is per million marriages of all ages. The co-ordinates of any two points, whatsoever, on any isoprotogam are equivalent age-pairs, that is pairs of ages which are characterised by the same frequency of marriage.

The protogamic surface, indicated by the family of curves or isogamic contours,

The protogamic surface, indicated by the family of curves or isogamic contours, is not the surface of frequency for indefinitely small ranges of age, but the surface for 5-year ranges of age; see hereunder. These contours or "isogams" are numbered 5, 10, 20, etc., denoting the doubling of the frequency. The point denoted by an asterisk near A, is the summit of this surface, i.e., its ordinates are the centre of the 5-year ranges of age for which the frequency of marriage is greatest. From the summit it falls most rapidly in the directions A, B and A, C, and least rapidly in the directions A, B and A E, the directions being shewn by broken lines.

The values on the protogamic surface can be thus interpreted:—Assuming that

The values on the protogamic surface can be thus interpreted:—Assuming that the frequency of marriage for given pairs of ages, is as in Australia during the eight years, 1907-1914, in every 1,000,000 marriages of brides and bridegrooms of all ages, the number to be expected in any 5-year group over the range of  $2\frac{1}{2}$  years earlier to  $2\frac{1}{2}$  years later than the ordinates of the point taken, in the case of both bride and bridegroom, will be that shewn by the corresponding isogam, along which there will be equal frequency of marriage. Thus, for example, following the variation with age contour corresponding to 10,240 marriages out of a total of 1,000,000, the frequency indicated will be very approximately that for the 5-year ranges, the middle values of which are brides 20 with bridegrooms 37; brides  $24\frac{1}{2}$  with bridegrooms 42; brides 35 with bridegrooms either 41½ or 29; brides 37 with bridegrooms either 40 or 33; and so on. The contours thus shew the centre values of a 5-year range of age, at which there is equal frequency of marriage within the range. That is, if the co-ordinates of any point on a contour be x and y, the frequency of marriage is for the ages bridegrooms  $x-2\frac{1}{2}$  to  $x+2\frac{1}{2}$ , with brides  $y-2\frac{1}{2}$  to  $y+2\frac{1}{2}$ . Hence if M be the total number of marriages, the actual number will be the number on the contour divided by 1,000,000 and multiplied by M.

#### Characteristics of the Protogamic Surface.

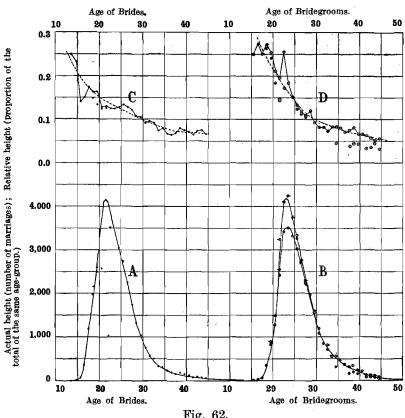


Fig. 62.

Curves A B C and D shew the various vertical features of the protogamic surface. Of these:—

Curve A shews the projection of the profile on the y or age-of-brides axis, the dots indicating the values according to the data, and the continuous line shewing the probable true position of the surface profile.

The outer Curve B shews the projection of the profile on the x or age-of-husbands axis, the dots and circles indicating the positions according to the data. The inner curve indicates the position of a series of second and fairly well-defined maxima. All the points shewn are maxima of some kind.

Curve C shews by dots, and a zig-zag line joining them, the proportion which the frequency at the various maxima bears to the totals for the same age-groups of The general trend of this frequency as a function of age is shewn by a broken

Curve D shews by dots with circles and by a zig-zag line, the proportion which the frequencies at the various maxima bear to the total for the same age-groups of bridegrooms. The broken line shews their general trend.

Each contour is twice the height of the contour immediately outside it; thus the surface rises with great rapidity, and is very steep on the top, and also the left hand side in the figure. The proportion per million marriages for a 5-year group, ranging between  $x \pm 2\frac{1}{2}$  and  $y \pm 2\frac{1}{2}$  is defined by the numbers written along the contours. The projection on the y-axis of the ridge running from the top left-hand corner to the

bottom right-hand corner is shewn by curve A, Fig. 62; and its projection on the x-axis is shewn by Fig. B. The proportion which the frequency at the maximum bears to the total for the same age-group of brides is shewn by curve C, and for the same age-group of bridegrooms by curve D. In these two last curves the zig-zag lines shew the successive principal maxima, and the dotted lines the general trend. It is probable that in a large population, when the ages at marriage are correctly given, the results would yield regular curves of the types drawn. The contours do not indicate curves of great regularity, but that is doubtless due (at least in part) to the inexact statement of age and the paucity of the numbers for higher ages.

27. Relative marriage frequency in various age-groups.—For sociologic purposes, a table shewing the relative marriage frequency in various age-groups is of obvious importance. Given an Australian population, constituted as to numbers of married and unmarried in age-groups as was its population during 1907 to 1914, 1,000,000 marriages are found to be distributed as follows:—

TABLE LXIII.—Relative Frequency of Marriage in Various Age-Groups. Australia, 1907-1914.

Age- group of							AGE-G	ROUP O	f Bri	DES.							ALL
Bride- grooms	10-14	15–19	20-24	25-29	30-34	35–39	40-44	45-49	50–54	55–59	60-64	65-69	70–74	75–79	80–84	85-89	AGES.*
15-19 20-24 25-29 30-34 35-39 40-45 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84	30 146 60 10 75 4 3 2 1 1	11,605 76,788 35,249 9,262 3,039 785 381 136 43 20 7 5	184,576 167,668 51,407 17,013 5,222 1,982 607 182 93 43	37,452 115,639 57,547 24,184 8,496 3,569 1,273	30,255 18,795 9,315 4,351 1,783 686 331 143 66	12 1,077 4,537 8,205 11,999 8,195 5,477 2,499 978 457 219 99 28	7 199 935 1,740 3,440 4,978 4,239 2,545 1,293 1,293 146 38 38 22	1,425 686 365 186 48	1,027 689 431 215 64	388 697 524 431 215 85	315 166	27 53 99 199 182 113 73	7 17 50 63 73 47	3 6 9 13 21 27	2 3 5 7	·· ·· ·· ·· ·· ·· ·· ·· ·· ·· ·· ·· ··	17,048 305,080 346,765 159,019 79,797 39,183 24,058 13,046 7,086 4,169 2,571 1,377 558 202
85-89			1	1	. 2	3	5	10		5	_3	2	1	1			42
All Ages*	271	137,324	433,750	249,345	92,906	43,799	20,398	11,358	5,438	2,778	1,465	781	270	8	30	. 3	1,000,000

\* These totals are about ten times those in the final columns of Table LX., p. 199. Though in substantial agreement they are not absolutely identical because these results have been slightly smoothed.

The above table is founded upon the results given by a slight smoothing of the actual numbers, and gives the roughly adjusted relative-frequency of marriage according to age-groups, based upon the marriages of the 8-year period, 1907 to 1914 inclusive, the 1911 Census being regarded as giving a sufficient indication of the relative numbers of married and unmarried for the computation of any derivative relations. The middle point of time would be Jan. 0, 1911, while the Census is April 3rd, 1911. The total marriages were 301,922, or about 37,740 annually; half of them had occurred by about April 28, 1911, that is 25 days after the Census, hence a correction is not required.

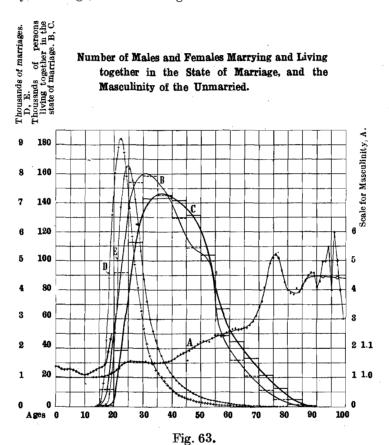
28. The numbers of the unmarried and their masculinity.—The smoothed results of the Census give the following numbers of unmarried at each age, viz., those shewn in Table LXIV. From these the ratios of the males to the females (M/F) have been computed; they are shewn opposite the letters "Mas." in the Table. From the numbers given the masculinities can be computed of the various age-groups, which are required hereinafter for the computation of the probability of marriage according to pairs of ages.

TABLE LXIV.—Number of Unmarried Males and Females and the Masculinity (M/F) at each Year of Age. Australia, 3rd April, 1911.

Year of Decen-				A	GES.					
nium in <b>Ag</b> e.	0	10	20	30	40	50	60	70	80	90
0 M	58,648	43,049	45,466	16,700	7,973	5,232	2,152	1,230	370	33
$\mathbf{F}$	56,401	42,654	38,370	10,839	4,987	2,340	830	360	92	8
Mas.	1.03984	1.00926	1.18493	1.54073	1.5987	2.2359	2.593	3.417	4.0	4.]
1 M	54,759	42,753	43,799	14,875	7,669	4,797	2,032	1,190	312	26
$\mathbf{F}$	52,982	42,222	34,634	9,659	4,623	2,127	760	320	- 80	1
Mas.	1.03354	$1.0\dot{1}258$	1.26462	1.54001	1.6588	2.2553	2.674	3.719	3.9	4.3
2 M	52,659	42,748	41,097	13,250	7,386	4,332	1,922	1,140	266	20
$\mathbf{F}$	51,145	42,001	30,878	8,730	4,226	1,938	715	280	69	4
Mas.	1 02960	1.01779	1.33094	1.51775	1,7477	2,2353	2,688	4,071	3.85	5.0
3 M	51,158	42,990	37,541	11,925	7,077	3,942	1,822	1,080	225	15
$\mathbf{F}$	49,785	42,072	26,360	7,835	3,940	1,780	690	240	58	3
Mas.	1.02758	1.02182	1.42418	1.52201	1.7962	2.2146	2.641	4.50	4.05	5.0
4 M	49,998	43,618	34,003	10,900	6,763	3,642	1.732	1,010	189	11
F	48,556	42,484	22,725	7,278	3,707	1,549	650	205	48	2
Mas.	1.02970	1.02669	1.49628	1.49766	1.8244	2.3512	2.665	4.927	3.94	5.5
5 M	48,812	44,598	30,338	10,177	6,453	3,342	1,622	920	158	8
$\mathbf{F}$ .	47,428	42,273	19,600	6,791	3,441	1,363	600	180	38	2
Mas.	1.02918	1.03062	1.54785	1.49860	1.8753	2.4519	2.703	5.11	4.16	4.0
6 M	47,543	45,482	26,823	9,529	6,185	3,042	1,490	810	121	1
$\mathbf{F}$	46,298	43,915	17,267	6,319	3,212	1,248	550	155	28	1
Mas.	1.02689	1.03568	1.55342	1.50799	1.9256	2.4375	2.709	5.23	4.32	6.0
7 M	46,084	46,212	23,597	9,032	5,957	2,762	1,396	690	90	5
${f F}$	45,111	43,813	15,370	5,910	3,000	1,145	500	135	20	1
Mas.	1.02157	1.05475	1.53526	1.52826	1.9856	2,4122	2.792	5.11	4.5	5.0
8 M	44,783	46,620	20,808	8,613	5,731	2,512	1,328	560	<b>%</b> 5	4
$\mathbf{F}$	44,055	42,854	13,646	5,630	2,783	1,032	450	120	14	]
Mas.	1.01652	1.08788	1.52484	1.52984	2.0593	2.4341	2.951	4.67	4.6	4.0
9 M ·	43,770	46,470	18,677	8,265	5,522	2,302	1,272	450	46	3
$\mathbf{F}$	43,236	41,020	12,153	5,303	2,570	910	405	105	10	1
Mas.	1.01235	1.13286	1.53682	1.55855	2.1486	2.5297	3.141	4.28	4.6	3.0

<sup>100</sup> and over—Males, 2; Females, 1. Totals under 13, 662,764, 611,873 = 1.08317. Note.—The masculinity is for the year-groups, and may be assumed to be the masculinity at age  $x+\frac{1}{2}$ , where x is the tabular age, viz., the "age last birthday."

The change of masculinity with age follows no simple law, as will be seen from curve A on Fig. 63. The irregularities after 80 are due to the relatively small numbers on which the curve is based, and must be regarded as accidental. The masculinity diminishes in the earlier years, because of the greater mortality among males. Its constancy between the ages 25 and 37 is remarkable, as also is the sudden increase commencing at 66 years of age, and continuing to 76.



Curve A denotes the variation with age of masculinity (M/F) of the unmarried. The small lozenge-shaped dots are the values according to the data; the continuous line shews the general trend. The scale for the masculinity up to nearly 20 years has also been plotted on ten times the scale. See Table LXIV., p. 212.

Curve B denotes the number of married females of marriages living with their husbands in a total of 1,000,000 couples. See Table LXVIII., p. 224.

Curve C denotes the number of married males of various ages living with their wives, in a total of 1,000,000 couples. See Table LXVIII., p. 224.

Curve D shews the adjusted number of females of various ages, per 100,000 marriages, occupying between 1907 and 1914. See Table LIX., p. 197.

Curve E shews the adjusted number of males of various ages, per 100,000 marriages, occurring between 1907 and 1914. See Table LIX., p. 197.

29. The theory of the probability of marriages in age-groups.—The data do not exist for a definite and rigorous determination of the probability of marriage in age-groups; nevertheless a fairly accurate estimate is possible by means of a somewhat empirical theory, which will now be indicated. The deduced results are shewn in Tables LXVI. and LXVII., see pp. 219 to 222.1

For convenience the adjusted numbers from the Census are given in Tables LXIV. and LXV. hereinafter; the corresponding numbers of marriages occurring in each age-group are also given. The values of q given in the tables enable the number of marriages likely to occur in each age-group to be computed when the numbers of unmarried males and females in the group are known. Thus, q being the tabular number, the number of marriages, N, may be computed by means of formula (431) or formula (434) hereinafter. (See next section.)

Suppose that in any age-group there are M unmarried males and Funmarried females; and that in a unit of time N pairs of these marry. The probability with F females in the group, of a particular marriage occurring among the M males is obviously N/M; and with M males in the group, the probability of a particular marriage occurring among the F females is similarly N/F. Such a statement of probability, however, lacks generality. To obtain a more general one, an expression is needed which, given a definitive tendency towards the conjugal state in males and in females, though not necessarily of the same strength (or potential) in each sex, and not necessarily independent of the relative numbers of the sexes, nor even independent of the lapse of time, will give the number of marriages occurring in a group, constituted in any manner whatever in regard to the numbers of either sex. We shall call the tendency to marry the conjugal potential under a given condition. In the case of males let the conjugal potential be denoted by  $\gamma$ , and in the case of females by  $\gamma'$ ;  $\gamma$  and  $\gamma'$  vary with age, doubtless also with time, and (we may assume) with the relative frequency of M and F. Without asserting it to be exactly the law of variation, we may suppose that the conjugal potential varies somewhat as some constant, multiplied into some power of the ratio of the numbers of the unmarried of each sex. Put p for the constant in the case of males, p' for the constant in the case of females, then the conjugal potentials are of the type  $p. f\left(\frac{M}{F}\right)$ , which function can, for all practical purposes, probably take the form

(425).....
$$\gamma = p\left(\frac{M}{F}\right)^r$$
; and  $\gamma' = p'\left(\frac{F}{M}\right)^s$ 

formulae in which r and s are indices to be ascertained by experiment.

<sup>&</sup>lt;sup>1</sup> These results are on the basis of 10 million males, and the same number of females. Hence if they are multiplied by one ten-millionth of 1,508,623, and 1,277,259 respectively, they will give the absolute numbers, since these were the number of unmarried males and of unmarried females respectively, on 3rd April, 1911.

Thus  $\gamma=p$  and  $\gamma'=p'$  when the numbers of unmarried of either sex are equal; ordinarily they do not differ sensibly therefrom. Again, if the number of females be large, the  $\gamma$  potential is doubtless smaller; and if the number of males be large the  $\gamma'$  potential is smaller. This appears to be confirmed by experience. The expressions (425) can be made to fit the facts by appropriately determining r and s.

From (425) we have at once for the ratio of the conjugal potentials

$$(426).....\frac{\gamma}{\gamma'} = \frac{p}{p'} \left(\frac{M}{F}\right)^w,$$

where w=r+s, from which it is evident that it is not necessary to ascertain r and s individually, but only their sum, w. And if the conjugal potential vary with age, it could be ascertained only by comparing a series of results for the one age-group when the numbers of males and females were very divergent; all other circumstances promoting marriage remaining constant. For this reason, with the limitations of existing data, we must assume (which doubtless, as already indicated, is not exactly true), that, when the numbers of the unmarried of each sex are equal, the conjugal potential and probability of marriage vary in the same way. That is

$$(427)....\gamma / \gamma' \propto p/p';$$

or the probability of marriage is the effective measure of the conjugal potential; or in other words (subject to what has been said above) we may suppose that, with equal numbers of unmarried males and females, the frequency of marriage is a normal measure of the conjugal potential.

If we make still another assumption, viz., that indicated hereunder (in the passages in italics), a crude type of solution becomes possible, and the problem may then be envisaged as follows:—

If there be M males in any age-group and F females in any other age-group, it is obvious that there can be MF marriages of particular pairs among these groups: and if a group out of these of N males and N females be taken, it is similarly self-evident that they can form NN marriages of particular pairs. Consequently assuming that the marriage of particular pairs is equally probable, and that the relative magnitude of M and F does not influence the probability, p, then the chance of N marriages occurring is

$$(428)\ldots p_{xy} = N_x N_y / (M_x F_y)$$

x and y denoting the age-groups referred to. The value of p cannot possibly become unity unless M=F=N. This probability does not, however, enable us to compute the likelihood of N marriages occurring with particular values for M and F, since obviously N is not  $\sqrt{p}$ .  $\sqrt{(MF)}$ , although that is a solution of equation (428). Subject to the assumptions

<sup>&</sup>lt;sup>1</sup> For example, given M constant, N would depend upon  $\sqrt{F}$ , which is certainly not correct if M be large and F small. In this case N would evidently vary as F, not as  $\sqrt{F}$ .

made, the function representing the chance of N marriages occurring must clearly vary approximately as  $\sqrt{(M F)}$ , when they are sensibly equal, and must vary sensibly as F (or M) when M (or F) is relatively very large.

In order to obtain an expression that will readily fulfil the necessary conditions, we may observe that if we put

$$(429).....N_{xy}=q_{xy}, \phi(M_x), \psi(F_y)$$

and for ready computation assume that the functions  $\phi$  and  $\psi$  may, with sufficient precision, take the form  $M^{\xi}$  and  $F^{\eta}$ ; then  $\xi$  and  $\eta$  must fulfil the following conditions, viz.:—

- (a) In order to give kN, when the numbers of males and females are kM and kF (at the same time), we must have  $\xi + \eta = 1$ , so that  $k^{\xi} \cdot k^{\eta} = k$ .
- (b) As a consequence of this condition, viz., (a), it follows that when M = F,  $\xi = \eta$ , and each must be  $\frac{1}{2}$ .
- (c) In order that, when M is relatively very great (or small) as compared with F, N shall vary as F (or M),  $\xi$  (or  $\eta$ ) must become in such a case sensibly zero, and  $\eta$  (or  $\xi$ ) must become sensibly unity.<sup>1</sup>
- (d) The fundamental assumptions require also that the expressions shall be symmetrical in regard to M and F, *i.e.*, one can be had from the other by mere interchange.

In practical examples we may have the ratio of M to F varying from about 0.1 to about 10.0 through a wide range of important ages, so that a formula, to be of the widest application, should at least embrace this range. Up to 40 years of age M ranges from about F to 8F. A function that will fulfil the required condition as above indicated is

$$(430)....N \propto M^{\frac{F}{M+F}}.F^{\frac{M}{M+F}}$$

Consequently we may write instead of (429):-

$$(431)...N_{xy} = q_{xy}...M^{\frac{F}{M+F}}...F^{\frac{M}{M+F}} = q_{xy}...M\phi^{\frac{1}{1+\phi}} = q_{xy}...F\mu^{\frac{1}{1+\mu}}$$

and to find q from the results furnished in Tables LXIV. and LXV. we have,

$$(432).....q_{xy} = \frac{N_{xy}}{M\phi^{\frac{1}{1+\phi}}} = \frac{N_{xy}}{F\mu^{\frac{1}{1+\mu}}}; \text{ or }$$

$$(432a)....\log q_{xy} = \log N_{xy} - \frac{1}{1+\mu} \log M - \frac{1}{1+\phi} \log F,$$

x and y denoting the central values of the age-groups, i.e.,  $x \pm \frac{1}{2}k$ ,  $y \pm \frac{1}{2}k$  where k is the range of the group. The application of this formula can be greatly facilitated in the following way:—Let  $S_{xy} = M_x + F_y$ , that is, let

<sup>&</sup>lt;sup>1</sup>  $\xi$  is the quantity denoted by  $\phi_2$ , and  $\eta$  that denoted  $\mu_2$  on page 132 hereinbefore.

 $S_{xy}$  denote the total number of single persons in the groups of males of age x and females of age y, and let the masculinity (or the femininity) of S be denoted by M/F (or F/M); then assuming that the probability is identical for A males and B females, with that for B males and A females (which, however, though by no means certain, is not determinable from existing data), we may compute the value of the ratio

$$(433)...R_{\mu} = R_{\phi} = \left(M^{\frac{F}{M+F}}.F^{\frac{M}{M+F}}\right) / \frac{1}{2}(M+F) = F\mu^{\frac{1}{1+\mu}} / \frac{1}{2}S = M\phi^{\frac{1}{1+\phi}} / \frac{1}{2}S$$

which depends merely upon the masculinity,  $\mu$  (or the femininity  $\phi$ ), and is independent of the absolute value of S, or of M and F. Consequently with a table of values of R arranged according to the argument  $\mu$  (or  $\phi$ ), we have, by simply dividing M by F, (or F by M) and entering the table,

$$(434)$$
..... $N_{xy}=rac{1}{2}\,S_{xy}$ ,  $R_{\mu}$ ,  $q_{xy}= ext{say}\,rac{1}{2}\,S_{xy}$ ,  $Q_{xy}$ 

Q itself could be tabulated but for the fact that the masculinity in age-groups may differ appreciably with the lapse of time. We require, therefore, two tables, viz., one for R depending upon the masculinity (or femininity), and one for q depending on the frequency of marriage for the age-groups in question. After preparing a table of the values of R, Table LXV., those of q can readily be calculated. In using the following table of the values of R, it is, of course, a matter of indifference whether it be entered with the argument "masculinity" or "femininity."

## TABLE LXV.

Values of  $R=(M^{\overline{M}+F},F^{\overline{M}+F})/\frac{1}{2}S$ , for computing the effect of unequal numbers of unmarried males and females on the frequency of marriage.

M/F and F/M are interchangeable.

								V.	LLUES	or—										
M F	F M	10000 R	M F	F M	10000 R	M F	F M	10000 <b>R</b>	M F	F M	10000 R	M F	F M	10000 R	M F	$\frac{\mathbf{F}}{\mathbf{M}}$	10000 R	M F	F M	10000 R
1.0	1.0	10000	2.0	.5000	8,399	3.0	.3333	6,580	4.0	.2500	5,278	5	.2000	4,359	15	.0667	1,481	60	.0167	351
	.9091	34			203 8,196 200	3.1		152 6,428 147			107 5,171 102	1	ļ	668 3,691 503	16		96 1,385 84	70	.0143	
	.8333	9,876 130			7,996 195	3.2		6,281 142			5,069 100	•		3,188 388	17		1,301 76	80	.0125	
	.7692	159			7,801 191			6,139			4,969 96 4,873	1		2,800 309 2,491			1,225 66 1,159		.0111	
	.7143	178			7.610 186 7,424	1		6,003 132 5,871			4,878 93 4,780			249 2,242			1,159 61 1,098		.0050	-
1.6	.6250	9,216 200	2.6	.3846	180 7,244		.2778	127 5,744		.2174	90 4,690 87	11	.0909	207 2,035 173		.0400			.0025	51
1.7	.5882	9,016 204	2.7	.3704	7,070 169	3.7		123 5,621 118	4.7		4,603 84	ı	.0833	1,862 146	30	.0333	186	700	.0014	
	.5556	207	1		6,901 163	1		5,503 115			4,519 81	ı		1,716 126		.0250	111		.0010	
1.9	.5263	8,605 206		.3448	6,738 158		.2564	5,388 110		.2041	4,438 79	14	.0714	1,590 109		.0200	423	2000	.0005	10
	·				T 11			(( = 0 0							-			-		

In the columns "10,000 R," the "differences" are also shewn.

From the values in the above table, a working table may readily be constructed so as to avoid tedious calculations of the function R.

When, however, the value of M is large, and that of F is small (or *vice versa*), the value of N depends mainly on F (or on M). In this case it is preferable to use a table of the values of  $\mu^{\frac{1}{1+\mu}}$  (or of  $\phi^{\frac{1}{1+\phi}}$ ) with the argument  $\mu$  (or  $\phi$ ); see formulæ (431) or (432) just given. A table such as LXVA, will then be required.

The formula to be used will be

$$(435).....N_{xy}=F.R'_{\mu}.q_{xy}=M.R'_{\phi}.q_{xy};$$

in which  $R'_{\mu}$  is the tabular value  $\mu^{\frac{1}{1+\mu}}$  and  $R'_{\phi}$  is the tabular value  $\phi^{\frac{1}{1+\phi}}$ , the q quantities being as before.

### TABLE LXVa.

Values of  $R'=2\mu^{\frac{1}{1+\mu}}$ , for computing the effect of unequal numbers of unmarried males and females on the frequency of marriage.

$\frac{\mathbf{M}}{\mathbf{F}} \mathbf{F} \frac{\mathbf{F}}{\mathbf{M}}$	R'	$\frac{M}{F} \text{ or } \frac{F}{M}$	R'	$\frac{M}{F} \text{ or } \frac{F}{M}$	R′	$\frac{\mathbf{M}}{\mathbf{F}}$ or $\frac{\mathbf{F}}{\mathbf{M}}$	R′
10	1.2328	60	1.0694	200	1.0267	700	1.0094
20	1.1533	70	1.0616	300	1.0192	800	1.0084
30	1.1159	80	1.0556	400	1.0150	900	1.0076
40	1.0958	90	1.0507	500	1.0124	1,000	1.0069
50	1.0797	100	1.0467	600	1.0107	2,000	1.0038

The table shews very clearly that as the unmarried females (or males) become relatively fewer the number of marriages varies more nearly in the proportion of the number of females (or males).

30. Masculinity of the unmarried in various age-groups.—The results embodied in Table LXIV., make it possible to compute the masculinity of the unmarried for any combined age-groups, since this affects the number that may be expected to marry. The masculinities are shewn in two tables, viz., Table LXVI. and Table LXVII., the former giving the results for 2-year age-groups for ages 15 to 44 for bridegrooms, and ages 13 to 44 for brides; and the latter the results for 5-year age-groups for ages 15 to the end of life for bridegrooms, and 10 to the end of life for brides. From the values of M/F, =  $\mu$ , (or F/M, =  $\phi$ ,) the values of F/(M+F) and of M/(M+F) may be readily computed if required. Thus<sup>1</sup>

(436).. 
$$\frac{F}{M+F} = \frac{1}{1+\mu} = \frac{\phi}{1+\phi} = \phi_2$$
;  $\frac{M}{M+F} = \frac{1}{1+\phi} = \frac{\mu}{1+\mu} = \mu_2$ 

<sup>&</sup>lt;sup>1</sup> For other definitions of masculinity and femininity see Part X.,  $\S$  3, (333) to (335), and Table XXI., pp. 132, 133 hereinbefore.

TABLE LXVI.—Shewing the Masculinity of the Unmarried in 2-year Age-groups (M/F), and the Probability-function 1,000,000  $_2q_{xy}$  for calculating the Number of Marriages in the Two-year Age-groups indicated.

Age Group.	$13-14 \\ 84,574$	15–16 87,188	17–18 86,667	19–20 79,390	$\begin{array}{c} 21-22 \\ 65,512 \end{array}$	$23-24 \\ 49,085$	25–26 36,867	27-28 $29,016$
15-16 90,080	1.065	1.033 15	1.039	1.135 15	1.375	1.835	2.443	$\frac{-}{3.104}$
17-18	1.098	1.064	1.071	1.170	1.417	1.891	2.518	3.199
92,832	6.	273	905,.	515	253	96	54	23
19-20 91,936	1.087 16	1,054 691	1.061 3,959	1.158 5,081	1.403 3,134	1.873 1,257	2.494 691	$\frac{3.168}{286}$
21-22	1.004	0.974	0.979	1.069	1,296	1.729	2.303	2.926
84,896	38	1,100	8,420	14,490	21,328	10,494	5,304	2,742
23-24 $71,544$	$\begin{array}{c} 0.846 \\ 16 \end{array}$	0.821 795	0.826 6,391	$0.901 \\ 14,652$	1.092 26,492	1.458 <b>24,774</b>	1.941 13,917	2.466 7,057
25-26 57,161	$0.676 \\ 15$	0.656 696	0.660 4,999	0.720 $11,579$	0.873 23,148	1.164 26,102	1.551 25,173	1.970 14,407
$27-28 \ 44,405$	0.525 13	0.509 473	0.512 3,867	0.559 9,172	0.678 18,819	0.905 2,1970	1.205 22,699	1.530 20,553
29-30 35,377	0.418	0.406	0.408 $2,552$	$0.446 \\ 6,632$	0.540 13,383	$0.721 \\ 15,776$	0.960 17,670	1.219 16,710
31-32	0.333	0,323	0.325	0.354	0.429	0.573	0.763	0.969
28,125	8	238	1,719	4,436	9,529	10,650	12,658	12,193
$33-34 \ 22,825$	0.270	0.262	0.263 1,398	0.287 3,408	0.348 6,950	0.465 8,707	0.619 9,068	0.787 9,683
35–36 19,706	0.233	0.226 211	0.227 1,055	$0.248 \\ 2,497$	0.301 5,450	0.402 6,074	0.534 7,830	0.680 7,804
37–38 17,645	0.209	0.202	$0.204 \\ 733$	0.222 1,823	0.269 3,831	0.359 5,156	0.479 5,392	0.608 6,775
39–40 16,238	0.192	0.186 153	0.187 453	0.205 1,317	0.248 2,542	0.331 3,153	0.440 4,035	0.560 4,477
41-42 15,055	0.178	0.173	0.174 275	0.190 678	0.230 1,538	0.307 $2,041$	0.408 2,390	0.519 2,977
43-44 13,840	0.164	0.159	0.160 154	0.174 465	0.211 1,082	0.282 1,551	0.375 1,726	$0.477 \\ 2,427$

See Note to the continuation of the Table on the next page.

**TABLE LXVI.**—Shewing the Masculinity of the Unmarried in 2-year Age-groups (M/F), and the Probability-function 1,000,000  $_2q_{xy}$  for calculating the Number of Marriages in the Two-year Age-groups indicated. (Continued).

		AGE O	F BRIDES	AND NU	MBER OF	Unmarri	ED FEMAI	les.	
	Age	29-30	3132	33–34	35-36	37–38	39–40	41–42	43–44
	Group.	22,992	18,389	15,113	13,110	11,540	10,390	8,849	7,647
	15–16 90,080	3.918	4.899	5.960	6.871	7.806	8.670	10.18	11.78
	$17-18 \\ 92,832$	4.038	5.048 13	6.142	7.081	8.044	8.935	10.49	12.140
LES.	19-20 91,936	3.999 225	4.999 88	6.083 83	7.013 52	7.967 34	8.849 19	10.39 11	12.022
UNMARRIED MALES.	21-22 84,896	3.692 1,405	4.617 865	$5.618 \\ 450$	6.476 392	7.357 161	8.170 143	$9.594 \\ 102$	11,102 93
MARRI	23–24	3.112	3.891	4.734	5.457	6.199	6.886	8.085	9.356
	71,544	4.241	2,010	1,422	905	694	375	167	105
OF UN	25–26 57,161	$\frac{2.486}{7.574}$	3.108 4,090	3.782 2,318	4.360 1,600	4.953 881	5.502 571	6.460 372	7.475 218
MBER	27-28	1.931	2.415	2.938	3.387	3.848	4.274	5.018	5.807
	44,405	11,620	6,269	4,043	2,421	1,877	1,000	441	339
N CIN	29-30	1.539	1.924	2.341	2.699	3.066	3.405	3.998	4.626
	35,377	15,147	8,170	5,493	3,430	2,152	1,287	714	471
OMS A	$31-32 \\ 28,125$	1.223 12,319	1.529 10,652	1.861 6,073	2.145 4,133	2.437 2,354	2.707 1,409	3.178 789	3.678 517
DEGRO	$33-34 \\ 22,825$	0.993 9.604	1,241 8,016	1.510 7,563	1.741 5,146	1.978 2,948	2.197 1,750	2.579 1,100	2.985 939
Age of Bridegrooms and Number of	35–36	0.857	1.072	1.304	1.503	1.708	1.897	2.227	2.577
	19,706	8,384	6,901	6,836	6,247	3,874	2,745	1,349	1,124
AGE	37-38	0.767	0.960	1.168	1.346	1.529	1.698	1.994	2.307
	17,645	6,209	5,546	5,870	5,558	5,695	3,571	1,775	1,354
	39–40	0.706	0.883	1.074	1.239	1.407	1.563	1.835	2.123
	16,238	5,565	4,343	4,793	5,104	4,966	4,968	2,837	1,725
	41–42	0.655	0.819	0.996	1.148	1.305	1.450	1.701	1.969
	15,055	3,242	3,783	3,430	4,119	3,323	3,354	3,314	2,123
	43–44	0.602	0.753	0.916	1.056	1.199	1.332	1.564	1.810
	13,840	1,819	2,792	3,170	3,049	3,185	3,194	2,833	2,871

Note.—The upper figures denote the masculinity of the group, that is, the ratio of the number of all the unmarried males of the 2-year groups of ages (15 and 16 to 43 and 44), to the number of all the unmarried females of the 2-year groups (13 and 14 to 43 and 44). The lower figures are the values of the probability-function,  $_2q_{xy}$ , for the double 2-year groups, by means of which the number of marriages occurring annually in the indicated age-groups may be calculated by formulæ (431) and (432), (434), and (435).

TABLE LXVII.—Shewing the Masculinity (M/F) of the Unmarried in 5-year Agegroups (M/F), and the Probability-function, 1,000,000  $_5q_{xy}$ , for calculating the number of Marriages in the 5-year Age-groups indicated.

Age of Brides and Number of Unmarried Females.

Age Groups.	$10-14 \\ 211,433$	$^{15-19}_{214,875}$	$20-24 \\ 152,967$	25-29 78,036	$30-34 \\ 44,341$	35-39 29,953	$40-44 \ 21,483$	45–49 15,006	$50-54 \\ 9,734$
15-19 $229,382$	1.085	1.067 1,964	$1.500 \\ 1,027$	2.939 150	5.173 37	7.658 11	10.677	15.29	23.57
20-24 $201,906$	$0.955 \\ 26$	0.940 13,850	1.320 $40,184$	2.587 $13,821$	4.553 3,068	6.741 1,054	9.398 280	13.45 152	20.74 44
25-29 $120,243$	0.569	$0.560 \\ 8,932$	$0.786 \\ 47,073$	1.541 $46,906$	2.712 14,445	4.014 4,309	5.597 1,239	8.013 512	12.35 $212$
30-34 67,650	0.320	0.315 3,897	$0.442 \\ 22,202$	0.867 $29,880$	1.526 $21,665$	2,259 8,006	3.149 2,305	4.508 921	6.950
35–39 45,616	0.216	$0.212 \\ 1,906$	$0.298 \\ 10,601$	$0.585 \\ 16,323$	1.029 $15,687$	1.523 12,726	2.123 4,724	$3.040 \\ 1,970$	4.686
40-44 36,868	0.174	0.176 618	0.241 4,033	0.472 6,800	0.832 8,721	1.231 9,356	1.716 7,127	2.457 3,259	3.787 1,084
45–49 29,858	0,141	$0.139 \\ 376$	0.195 1,907	0.383 3,439	0.673 4,664	0.997 6,875	1.390 6,452	1.990 5,656	3.067 $2,551$
$50-54 \\ 21,945$	0.104	0.102 188	0.144 812	$0.281 \\ 1,647$	$0.495 \\ 2,415$	0.733 3,746	1.022 4,399	1.462 4,794	2.255 $4,041$
55–59 13,960	0.066	0.065 98	$0.091 \\ 401$	0.179 858	0.315 1,399	0.466 2,062	0.650 2,932	$0.930 \\ 3,700$	1.434 3,415
60-64 9,660	0.046	0.045 68	0.063 306	$0.123 \\ 642$	0.218 980	0.322 1,715	0.450 1,658	$0.644 \\ 2,243$	$0.992 \\ 2,668$
65–69 7,108	0.034	0.033	0.046 198	0.091 379	0.160 584	0.237 876	0.331 1,141	0.474 1,514	0.730 1 <b>,9</b> 92
70-74 5,650	0.027	0.026 28	0.037 137	$0.072 \\ 221$	0.127 349	0.189 507	0.263 734	0.376 944	$0.580 \\ 1,172$
75-79 3,430	0,016	0.016	0.022 67	$0.044 \\ 127$	0.077 181	0.115 247	0.160 321	0.229 399	0.352 536
80-84 1,362	0.006	0.006 45	0.009 123	0.017 238	0.031 247	0.046 335	0.063 519	0.091 635	0.140
85–89 480	0.002	0.002 26	0.003 51	0.006	0.011	0.016 195	0.022	0.032 697	0.049 568
90-94 105	.0005	.0005	.0007	.0013	.0024	.0035	.0049	.0070	.0108

See Note to the continuation of the Table on the next page.

TABLE LXVII.—Shewing the Masculinity (M/F) of the Unmarried in 5-year Age-groups, and the Probability-function, 1,000,000  $_5q_{xy}$ , for calculating the number of Marriages in the 5-year Age-groups indicated. ( $Continue\ l$ )

AGE OF BRIDES	AND NUMBER	OF HAMADRIED	FEMALES
AGE OF DRIDES	AND NUMBER	OR UNMARKIND	PRIMALES.

Age Group.	55–59 5,698	60-64 3,645	65–69 2,505	70-74 1,405	75–79 695	$80-84 \\ 347$	85-89 110	90-
$\frac{15-19}{229382}$	40.26	62,93	91.57	163.3	330.1	661.0	2085	99
20-24 201906	35.43 18	55.39 10	80.60	143.7	290.5	581.9	1835	87
$25-29 \ 120243$	21.10 32	32.99	48.00	85.58	173.0	346.5	.1093	52
30-34 67,650	11.87 72	18.56	27.01 43	48.15	97.34	194.9	615.0	29
35-39 45,616	8.006 260	12.51 113	18.21	32.47 8	65.63	131,5	414.7	198
40–44 36,868	6.470 442	10.11	14.72 126	26.24 16	53.05	106.2	335.2	160
45-49 29,858	5.240 1,236	8.192 651	11.92 328	21.25 77	42.96 16	86.05	271.4	129
$\frac{-}{50-54}$ $21,945$	3.851 1,9 <b>34</b>	6.021 1,321	8.760 636	15.62 150	31.58 145	63,24 34	199.5	954
55–59 13,960	2.450 3,030	3.830 1,680	5.573 1,147	9.936 338	20.09 290	40.23 164	126.9	607
60-64 9,660	1.695 2,835	2.650 2,769	$3.856 \\ 2,257$	6.875 1,039	13.90 405	27.84 319	87.82 107	<b>42</b> 0
65-69 7,108	$1.248 \\ 2,572$	1.950 2,585	2.838 2,081	5.059 1,287	10.23 582	20.48 467	64.62 212	309
70-74 5,650	0.992 1.425	1,550 1,437	2.256 1.315	4.021 1.476	8.129 896	16.28 610	51.36 314	245
75-79 3,430	0.602 764	0.941 979	1.369 957	2.441 970	4.935 1,094	9.885 958	31.18 406	149 40
80-84 1,362	0.239 610	0.374 475	0.544 295	0.969 207	1.960 171	3.925 163	12.38	59.5
85–89 480	0.084 341	0.132 205	0.192	0.342	0.691 45	1.383 31	4.364	20.
90-94 105	0.184 221	0.288	.0419	.0747	.1511	.3026	.9545	4.5

Nore.—The upper figures denote the masculinity of the group, that is, the ratio of the number of all the unmarried males of the 5-year groups of ages (15 to 19) to (90 to 94), to the number of all the unmarried females of the 5-year groups (13 to 14) to (90 to 94). The lower figures are the values of the probability-function,  $1,000,000_{5}q_{xy}$ , for the double 5-year groups, by means of which the number of marriages occurring annually in the indicated age-groups may be calculated by formulae (431) and (432), (434), and (435).

31. The probability of marriage according to pairs of ages.—Assuming that the "conjugal potential" does not change in any community, the number of marriages likely to occur among groups of the unmarried of given ages can be computed by means of formula (434), at least if the masculinity is at all similar to that shewn in Tables LXVI. and LXVII. These tables give also the values of  $q_{xy}$  as well as the masculinity.

If the conjugal potentials are the same for A males and B females as for B males and A females, and the law of variation is, as by hypothesis,

$$(437).....(\gamma+\gamma')\propto M^{\phi_2}$$
 ,  $F^{\mu_2}=M\phi_1^{\mu_2}=F\mu_1^{\phi_2}$ 

then the qualification as to the masculinity being approximately identical disappears.¹ It is not unimportant, however, to remember that the fundamental assumption would have to be very erroneous (and that would seem to be impossible) in order to seriously prejudice the precision of the result obtained by the application of the formula (434). The error in any real application of the formula can be a differential one only, and if the constitution as regards numbers of the population be approximately therefore that from which it was derived, any defect in the theory of variation with relative numbers of the sexes, formula (430), has no sensible effect.

32. The relative numbers of married persons in age-groups.—The Census of 1911 disclosed the fact that the number of married persons living together on the night of the 3rd April, 1911, was 623,720. The number of wives absent from their husbands was 112,129, and husbands absent from their wives 110,053. There were 616,738<sup>2</sup> (out of a total of about 734,000 married couples) whose ages were fully specified, and who were living together.

This may not be a perfect sample of the entire population, for although the date of the Census, viz., 3rd April, is well chosen, the number of spouses of each age apart at a given moment is probably not sensibly proportional to the total number. As the totals, however, are only about one-fifth greater than the number for which the information is complete, the 616,738 may be taken as fairly representing the population. The results are shewn upon Table LXVIII.

 $<sup>^1</sup>$   $\mu_1$  and  $\phi_1$  are the same as  $\mu$  and  $\phi$  above ;  $\mu_2$  and  $\phi_2$  are defined in Table XXI. p. 132 hereinbefore.

This number is made up as follows:—

Husbands and wives com-

pletely specified as to age,			
and living together 616,738	Living to- Living to-		
	gether but gether but	Wives	Total
	Wife's Age Husband's	Absent.	
Both ages unspecified 506			
	stated. stated.		
617,24	+ 4,108 $+$ 2,368 $+$	- 112,129	= 735.849
Living together but wife's	•	•	-, -
age not stated 4,108			II
Living together but hus-			"
age not stated 2,368	1		1.19313
Husbands absent 110,055	3		×
·	-		
Total wives $\dots = 733,773$	= 1.18976	×	616,738

TABLE LXVIII.—Number of Married Persons per 1,000,000 Married Couples, Living Together on the Night of the Census, 3rd April, 1911. In 5-year Age-groups.

TT					_			<b>W</b> 1	ives' A	GES.								_	Total,
Hus- bands' Ages.	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 59	80 to 84	to	90 to 94	to	10 to 99
15-19 20-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85-89 90-94 95-99 100-104	8 2	577 5,771 3,574 1,090 376 130 44 24 111 5  2 2	17,907	54,838 54,009 24,489 9,082 3,287 1,090 334 135 62 26 23	8 1,090 11,871 54,757 51,157 25,695 9,510 3,124 921 357 156 58 29 15 2	3 217 2,015 12,145 147,680 23,654 7,694 2,380 798 413 180 577 24 6	63 383 2,264 10,786 44,462 43,567 19,245 5,567 1,899 131 42 10 2	28 112 1,965 9,936 40,083 35,589 13,677 4,506 1,718 268 79 16 6	44 123 379 1,934 8,644 29,716 22,851 9,790 4,081 1,505 517 152 28 1	11 29 452 1,450 5,809 13,578 6,684 2,615 820 227 53 3 2	1,138 3,478 10,622 9,571 4,405 1,600 472 84 8	15 111 36 96 311 666 2,330 7,639 6,040 2,996 751 148 34 5	2 3 10 16 50 154 478 4,533 3,322 1,156 198 37 5	2 3 10 13 41 81 292 1,004 2,238 1,111 267 31	   3 11 18 42 118 399 655 183 36	2 8 15 37 84 91	 1  8 26 6 15	· · · · · · · · · · · · · · · · · · ·	974 38,366 112,707 142,858 143,009 141,560 131,489 104,055 66,954 44,645 33,270 21,552 12,452 4,801 1,094 183 28
Totals 15–104	10	11,606	91,713	154,087	158,750	145,157	129,598	109,339	79,771	48,584	31,841	21,070	11,593	5,098	1,471	258	52	2	1,000,000

33. Conjugal age-relationships.—For certain estimations it is important to know, for given ages of husbands, the average difference of the age of the wives; and also for given ages of wives the average differences of the ages of the husbands. These relationships as at marriage, i.e., initially, may be ascertained from marriage records. They may be called the protogamic age-relationships. The instantaneous relationships at any moment, however, are disclosed only by a Census, and may be called the gamic age-relationships.

The age-groups, with the age of the husband as argument, and those with age of wife as argument, lead, it will be found, to different results, which have no obvious direct mutual relation. Hence this, in common with other analogous groupings of a non-homogeneous character, must be independently made, for a reason which we shall now more definitively indicate. In cases of the kind under consideration two formulae are needed; in one the argument is the age of the husband (or bridegroom), in the other the age of the wife (or bride).

34. Non-homogeneous groupings of data.—If, associated with any group-range, viz.,  $x_k$  to  $x_{k+1}$  say, of any class of elements (ages of husbands in the case under review), there is a class of related elements (ages of wives), viz.,  $y_{k-a}$  to  $y_{k+b}$  say, where a and b, in general, have large values; and if, reciprocally, a group-range,  $y_k$  to  $y_{k+1}$  say, is associated

with the group  $x_{k-A}$  to  $x_{k+B}$  say, A and B also having large values, the result obtained from the former will have no simple relation with that based on the latter. For a result based on the argument x, has not the same constitution as one based on the argument y. If the distribution about the mode in such cases be not symmetrical in each, in fact if it be not similar in all respects, no direct functional relationship subsists between results for groupings arranged according to the values of x, and those for groupings arranged according to the values of y. Groupings subject to this limitation may be called non-homogeneous groupings, and require special consideration.

35. Average differences in age of husbands and wives, according to Census. — In Chapter XIX., Vol. I., § 2, of the Report on the Australian Census of 1911, results are given for a series of age-groups of husbands and of wives. The results are also given in greater detail in Vol. III., Table I., pp. 1106-7. The difference for the central-age of the group, which is sensibly, though not exactly, the mean-age, of those included therein, is as shewn on Fig. 64,1 the curve marked A, representing the excess of the age of husband over the average age of their wives, as determined from groupings according to the age of the wife over the average age of their husbands, as determined from groupings according to the age of the wives.

The differences are given in Table LXIX, hereunder. The tangent line to curve A is coincident with the curve for the ages 40 to 60 inclusive (beginning point of year); hence for this interval the relation is—

$$(438)...D_w = 0 + 0.098 x_h$$
, for ages 40 to 60,

 $D_w$  denoting the average excess in years of the age of the husband over the average age of the wives, and  $x_h$  being the age of the husband.

The tangent is coincident with curve B for the ages 30 to 67 inclusive, and the age of the wife is greater than the average age of the husbands by the amount  $D_h$ , where

$$(439) \dots D_h = -6.275 + 0.058 x_w$$
, for ages 30 to 67,

in which  $x_w$  denotes the age of the wife. It is obvious from the table that the assumption ordinarily made is invalid. The characteristics of a table of values of the differences will be evident from the table itself.

<sup>&</sup>lt;sup>1</sup> See page 227.

TABLE LXIX.—Differences of the average Age of Wives for Husbands of various Ages, and of the Average Ages of Husbands for Wives of various Ages. Australia, 1911.

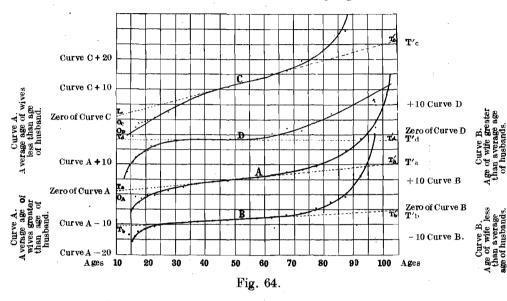
Age of	Calcu	lated Res	sult, Curve	э <b>А.</b>	Calculated Result, Curve B.							
Hus- band A; Wife B.	Position of Tangent	Ordin- ate to Curve.	Smoothed value of $D_w$ .	Crude value from Data.	Position of Tangent	Ordin- ate to Curve.	Smoothed value of $D_h$ .	Crude value from Data,				
$14\frac{1}{2}$ $15\frac{1}{2}$	$+1.42 \\ 1.52$	-6.52	-5.00	 5.0	-5.43 5.38	 5.02	10.40	8.4 10.4				
$16\frac{1}{8}$	1.62	$\frac{-0.32}{5.27}$	3.65	0.9	5.32	3.07	8.39	9.1				
$17\frac{1}{2}$	1.72	4.52	2.80	2.8	5.26	2.25	7.51	7.5				
181	1.81	3.78	1.97	1.2	5.20	1.76	6.96	7.2				
19‡	1.91	3.48	1.57	1.1	5.14	1.44	6.58	6.6				
$20rac{7}{2}$	2.01	3.12	1.11	0.6	5.09	1.16	6.25	6.2				
$23^{-}$	2.25	2.38	0.13	0.4	4.84	.80	5.70	5.7				
$27\frac{1}{2}$	2.70	1.33	+1.37	+1.2	4.68	17	4.85	4.7				
30 †		.90	2.05	• •	4.54	.0	4.54	• • •				
$32\frac{1}{2}$	3.19	.56	2.63	2.5	4.39	.0	4.39	4.4				
$37\frac{1}{2}$	3.67	.10	3.57	3.6	4.10	.0	4.10	4.1				
40 *	3.92	.0	3.92	• •	3.96	.0	3.96	• •				
$42\frac{1}{2}$	4.16	.0	4.16	4.2	3.81	.0	3.81	3.8				
$47\frac{7}{2}$	4.66	.0	4.66	4.7	3.52	.0	3.52	3.4				
$52rac{7}{2}$	5.15	.0	5.15	5.2	3.23	.0	3.23	3.1				
$57\frac{1}{2}$	5.64	.0	5.64	5.8	2.94	.0	2.94	3.0				
60 *	5.88	.0	5.88	• •	2.80	.0	2.80	• •				
$62\frac{1}{2}$	6.13	+.08	6.21	6.5	2.65	.0	2.65	2.9				
67 †	6.55	.19	6.74	• •	2.50	.0	2.50	٠				
$67\frac{1}{2}$	6.61	.20	6.81	7.3	2.36	+.08	2.28	2.3				
$72\frac{1}{2}$	7.11	0.66	7.73	8.1	2.07	.70	-1.37	-1.3				
$77\frac{1}{2}$	7.60	1.58	9.18	9.2	1.78	1.96	+0.18	+0.4				
$82\frac{1}{2}$	8.09	3.14	11.23	11.3	1.49	3.76	2.27	2.2				
87 <del>1</del>	8.58	5.70	14.28	14.4	1.20	6.70	5.50	4.2				
$92\frac{7}{2}$	9.07	9.10	18.17	18.6	0.91	12.01	11.10	11.1				
$97\frac{1}{2}$	9.56	14.90	24.46	22.3	0.62	+25.62	+25.00	+25.0				
$102\frac{1}{2}$	10.05	29.95	40.00	40.0	0.33			٠.				

<sup>\*†</sup> The asterisks and daggers denote the ages between which curves A and B, respectively, are straight lines.

In the figure the curves A and B are very approximately the smoothed values. The tangents are shewn by dotted lines; the data by the dots; it is instantly evident that the difference is not constant, but is a definite function of age. A and B are the curves of the gamic age-relationship.

36. Average differences of age at marriage.—A similar table to the preceding can be constructed for the ages at marriage. In order to eliminate the uncertainties due to paucity of data the results for the eight years 1907 to 1914 were combined. The combinations shewed the same tendency as was revealed by the Census, viz., for the numbers to be unduly large for the ages ending with the digits 0 and 5. The numbers for the purpose of the following table have, however, not been smoothed; the smoothing in the table itself making that unnecessary.

Differences between Ages of Husbands of any Age and the Average Ages of their Wives, and between the Ages of Wives and the Average Ages of their Husbands.



Curve A.—Excess of the husband's age over the average age of their wives, at the 1911 Census. See Table LXIX., p. 226. OA is the zero for the curve.

Curve B.—Excess of the wife's age over the average age of their husbands, at the 1911 Census. See Table LXIX., p. 226. OB is the zero for the curve.

Curve C.—Excess of the bridegroom's age over the average age of their brides, 1907-1914. See Table LXX., p. 228.

Curve D.—Excess of the bride's age over the average age of their bridegrooms. See Table LXX., p. 228.

The results are shewn by curves C and D in Fig 64. The tangent to curve C, which is analogous to curve A, is identical with the results for ages  $42\frac{1}{2}$  to  $67\frac{1}{2}$  years; thus:—

$$(440).....D'_{w} = -1.745 + 0.266 x_{h}; \text{ for ages } 42\frac{1}{2} \text{ to } 67\frac{1}{2}.$$

For curve D, the difference of ages is analogous to curve B. The tangent is parallel to the age-axis at the distance

$$(441)...D_h = -1.76$$
; for ages  $32\frac{1}{2}$  to  $60$ .

The table shews the differences outside these limits.

Towards the ends of the curves the results for all four curves are of course somewhat uncertain. C and D are the curves of the protogamic age-relationship.

TABLE LXX.—Difference of the Average Age of Brides for Bridegrooms of various Ages, and of the Average Age of Bridegrooms for Brides of various Ages.

Age of	Calcul	lated Re	sult, Curv	e C.	Calculated Result, Curve D.						
Bride- groom C; Bride D.	Position of Tangent	Ordin- ate to Curve.	Smoothed value of $D'_w$ .	Crude value from $D'_w$ .	Position of Tangent	ate to	Smooth- edvalue of $D'_h$ .	Crude value from Data D'			
$13\frac{1}{2}$ $14\frac{1}{2}$ $15\frac{1}{2}$ $16\frac{1}{2}$	$+2.38 \\ 2.64$	-5.35 5.08	 2.97 2.44	5.50 2.36	+1.76 $1.76$ $1.76$ $1.76$	$+11.04 \\ 8.45 \\ 7.10 \\ 6.10$	12:80 10:21 8:86 7:86	12.80 10.21 9.18 7.86			
$17\frac{1}{2}$ $18\frac{1}{2}$ $19\frac{1}{2}$ $20\frac{1}{2}$ $23$	2.91 3.18 3.44 3.71 4.37	4.85 4.56 4.35 4.08 3.49	$egin{array}{c} 1.94 \\ 1.38 \\ 0.91 \\ -0.37 \\ +0.88 \\ \end{array}$	$egin{array}{c} 1.08 \\ 0.81 \\ 0.37 \\0.18 \\ +0.49 \\ \hline \end{array}$	1.76 1.76 1.76 1.76 1.76	5.24 4.50 3.92 3.42 2.24	7.00 6.26 5.68 5.18 4.00	6.95 6.25 5.66 5.26 3.94			
$27\frac{1}{2}$ $32\frac{1}{2}$ † $37\frac{1}{2}$ $42\frac{1}{2}$ *	5.57 6.90 8.23 9.56	$2.52 \\ 1.48 \\ .56 \\ .00$	3.05 5.42 7.67 9.56	2.72 5.35 7.67 9.45	1.76 1.76 1.76 1.76	.70 .00 .00	2.46 1.76 1.76 1.76	2.46 1.76 1.72 1.91			
$47\frac{1}{2}$ $52\frac{1}{2}*$ $57\frac{1}{2}$ $60$ † $62\frac{1}{2}$	10.89 12.22 13.55	.00	10.89 12.22 13.55	10.95 12.30 13.42	1.76 1.76 1.76 1.76 1.76	.00 .00 .00 .00	1.76 1.76 1.76 1.76 1.82	1.66 1.75 1.31			
$   \begin{array}{c}     67\frac{1}{2} \\     72\frac{1}{2} \\     77\frac{1}{2} \\     82\frac{1}{2}   \end{array} $	14.88 16.21 17.54 18.87 20.20	.00 .90 2.30 4.50	16.21 18.44 21.17 24.70	16.16 16.16 19.52 19.93 37.05	1.76 1.76 1.76 1.76 1.76	.00 .28 .73 1.54 3.00	2.04 2.49 3.30 4.76	2.08 1.31 5.83 7.14			
$87\frac{1}{2}$ $97\frac{1}{2}$	$21.53 \\ 22.86$	8.09	29.62	29.62 	1.76 1.76	5.30	7.06	10.00			

 $<sup>\</sup>fint *\dagger$  The asterisks and daggers denote the ages between which the curves C and D , respectively, are straight lines.

37. The gamic surface.—The data furnished in Table LXVIII. may be used to construct the gamic surface, on the same principle as was followed in the construction of the protogamic surface, dealt with in § 25 hereinbefore. The results are shewn on Fig. 65, from which it will be seen that the isogams are more elliptical in form than isoprotogams, and are more regular; see Fig. 61. The principal meridians AB, AC and AD, AE are in much the same positions as on the protogamic surface, but the point of maximum frequency A, and the line of greatest slope are for higher ages than on that surface. The interpretation of the curves is, mutatis mutandis, the same as that for the isoprotogams; in the case of Fig. 65, however, everything applies to persons "living in the state of marriage," instead of to "persons at the moment of marrying."

# Curves of Equal Conjugal Frequency.—The Gamic Surface, 1911.

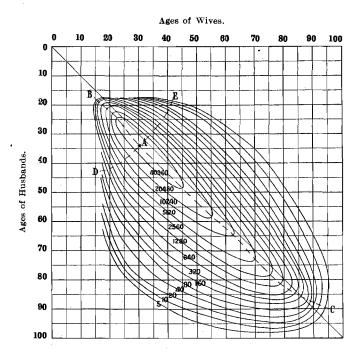


Fig. 65.

NOTE.—The pairs of ages for which an equal frequency of married couples existed at the Census of 1911 are found by following the course of any isogam. The remarks in the footnote to Fig. 61, p. 209, apply, mutatis mutandis, to the contours of the Gamic Surface.

38. Smoothing of surfaces.—Let it be supposed that the nature of statistical data is such that the most suitable representation is by means of the heights of series of parallelepipeds, as for example, in the case just considered, of the numbers of marriages of bridegrooms between given age limits and of brides between the same or other given age limits. For simplicity we may assume that the combination is according to age last birthday, and thus is in single year groups. Since the general equation of a surface of a second degree will involve nine constants, we can deduce the constants of a surface representing its integral between the limits x = 0, 1, 2, and 3, and y = 0, 1, 2, and 3, the deduced expression will give totals corresponding to those of the nine contiguous groups. By means of the corresponding surface equations, deduced from these, for lines parallel to the x-axis, or parallel to the y-axis, we can find the height to

this surface, along the four edges of the central parallelepiped. If this operation be then repeated, making each of the four adjoining parallelepipeds the central ones in a group, we shall obtain a second series of values for the distances along the four edges to the surface; if these do not differ very greatly then the means of each pair of values may be taken, in general, as the smoothed result. In this way the greater part of the entire surface can be dealt with, and the series of verticals to the surface thus found will have reduced the original irregularities, and may be regarded as a first smoothing of the surface, conforming, however, as nearly as possible to the general series of group-heights. The results so obtained, however, are "instantaneous values," that is, they are the heights corresponding to the ranges x to x + dx, and y to y + dy.

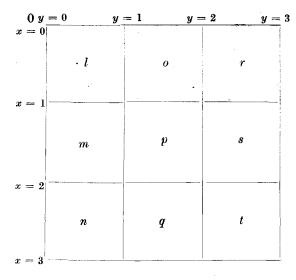
If the numbers be very irregular the process above indicated is extremely tedious, and of little value. It may then be preferable to regard the group results as vertical ordinates with the central values of the group-ranges as the horizontal co-ordinates. The procedure then involves the independent smoothing of a double system of curves, and the taking throughout of the means of the pairs of verticals so found. The whole procedure is then repeated, with the means thus obtained, until the smoothing is satisfactory. The criterion of good smoothing is that the "accumulated deviations" in either of the two directions (at right angles to one another) do not attain to appreciable values, and that they alternate in size. It should be noted that smoothing in this way does not give "instantaneous values," that is where k is the extent of the range, the heights now denote values true for the ranges  $\frac{1}{2}k$  on either side of the values x and y, these being the ordinates of the centre of the ranges.

There is another possible scheme of solution, viz., to ascertain the constants of an equation, which will give at once the group values for groups of the same double-range, the arguments being the ordinates of the centres of the groups. The method is analogous to that treated for a surface in Part V., § 10, formulæ (211) to (216), pp. 72-73, and the solution by a process analogous to that indicated in the section immediately following, will give the group-height for any value of x and y, the range being  $x \pm \frac{1}{2}k$ ,  $y \pm \frac{1}{2}k$ .

39. Solution for the constants of a surface representing nine contiguous groups.—The most general expression for a surface, every section of which parallel to the x-axis and parallel to the y-axis is a curve of the second degree is

$$(442)..z = A + Bx + Cy + Dxy + Ex^2 + Fx^2y^2 + Gy^2 + Hx^2y + Ixy^2$$

Let the values of the groups be denoted by the letters  $l, m \dots l$ , according to the following scheme:—



The integral of the above, divided by xy, the area of the base, is:

$$(443)....\frac{1}{xy}\iint F(x, y, k) dxdy = A + \frac{1}{2}Bx + \frac{1}{2}Cy + \frac{1}{4}Dxy + \frac{1}{3}Ex^2 + \frac{1}{3}Fy^2 + \frac{1}{6}Gx^2y + \frac{1}{6}Hxy^2 + \frac{1}{9}Ix^2y^2$$

from which we deduce, by putting x (or y) successively 1, 2, 3, and making y (or x) equal 1, 2, or 3, the following values of the constants A to I in terms of l, m, .....t. The results are :—

$$(444)...A = -(q+o-2p)+(n+l-2m)+(l-p)-3 (s-p)$$

$$+(t-q)+3 (r-o)+(p-o)-\frac{1}{2} (m-l)$$

$$(445)\dots B = 3(q+o-2p) - 3(n+l-2m) + 8(s-p) - 3(t-q)$$

$$-5(r-o) - 2(p-o) + (m-l)$$

$$(446)\dots, C = 2(q+o-2p)+2p-2(p-o)+9(s-p)-9(r-o)-3(t-q)$$

$$(447)...D = 4(p-o)-6(q+o-2p)-24(s-p)+15(r-o)+9(t-q)$$

$$(448)...E = \frac{3}{2} (n + l - 2m) - \frac{3}{2} (q + o - 2p) - 3 (s - p) + \frac{3}{2} (t - q) + \frac{3}{2} (r - o)$$

$$(449)...F = \frac{9}{2} (r - o) - \frac{9}{2} (s - p) + \frac{3}{2} (t - q)$$

$$(450)...G = -\frac{9}{2} (t - q) - \frac{9}{2} (r - o) + 9(s - p) + 3(q + o - 2p)$$

$$(451)...H = 12 (s - p) - \frac{15}{2} (r - o) - \frac{9}{2} (t - q)$$

$$(452)...I = \frac{9}{4} (t - q) + \frac{9}{4} (r - o) - \frac{9}{2} (s - p)$$

It will be seen that the arithmetical labour of deducing the constants of a surface which will exactly reproduce any square system of 9 contiguous group-values, is very great, and ordinarily prohibitively so. In general, therefore, less rigorous methods have to be adopted, and are ordinarily quite satisfactory, particularly in view of the fact that in practical calculations values according to a given double-range are required.

40. Nuptiality and conjugality norms.—It would appear desirable to establish decennially, what may perhaps be called a nuptiality or protogamic norm, and also a conjugality or gamic norm, on the basis of an aggregation of the marriages of a large number of populations for the former; and of the Census results for the latter. The norms should preferably shew single-year results up to 24 years for brides, and 29 years for bridegrooms; and up to 34 years for wives, and 39 years for husbands, respectively.

The protogamic norm will reflect the trend in regard to the early institution of marriage, and the gamic norm the modification of this by change in longevity, the frequency of divorce, etc. These norms could include the curves of the totals according to the age of the males (bridegrooms and husbands), and according to the age of the females (brides and wives), and could include also the frequency of the group-pairs.

The norms of the conjugal state, "never married," "divorced," and "widowed," might, with advantage—as well as those of the "married"—also give the frequencies according to group-pairs.

41. The marriage-ratios of the unmarried.—It has already been shewn that the probability of marriage depends, among other things, upon the relative numbers among the unmarried of the sexes. So long, however, as a population does not greatly change its constitution according to sex and age, the crude probability of marriage according to sex and age may be regarded as varying approximately as the annual rate. This probability may be called the *peithogamic coefficient*<sup>1</sup> for the sex and age in question. It will be further discussed in Part XIII. in connection with fecundity.

<sup>&</sup>lt;sup>1</sup> From  $\pi\epsilon i\theta\omega$  to prevail upon, (Πειθώ the Goddess of Persuasion) and γαμικός, of or for marriage.

# XIII.—FERTILITY AND FECUNDITY AND REPRODUCTIVE EFFICIENCY.

1. General.—The phenomena which directly concern the measure of the reproductive power of the human race will be dealt with in this part. These phenomena are in general complex, the variation of the reproductive power being in part of physiological origin, and in part of the result of the reaction of social traditions upon human conduct. This will appear in any attempt to determine the laws of what has been called bigenous¹ (better, digenous) natality, or natality as affected by the ages of both parents, as distinguished from those affecting merely monogenous natality, or natality as related to the producing sex. In deducing the most probable value for certain of the phenomena it will be necessary to minimise the effect of misstatement of age. This can probably be done more effectually than would at first sight appear probable. The final results, however, must be subject to some small degree of uncertainty.

The question of the reproductive efficiency of a population has in part been dealt with in Parts XI. and XII., dealing with Natality and Nuptiality; this, however, is derivative and depends in its turn upon the age-distribution and conjugal condition of the producing sex.

Many questions concerning the measurement of fertility and fecundity can be settled with sufficient precision without recourse to a differentiation depending on the age of the father, the better in Australia, perhaps, inasmuch as the decay of virility with age is not well marked, and in this aspect the digenous fertility stands in marked contrast with that of Hungary.

2. **Definitions.**—It is desirable, initially, to define the sense in which several terms will be used hereinafter.

Monogenous fertility and monogenous fecundity will denote the fertility and fecundity of the female considered without regard to the age of the associated male.

Digenous fertility and digenous fecundity will denote the fertility and fecundity of the female, as modified by the age of the associated male, and therefore is considered in relation to the ages of both males and females. Consequently computations of monogenous fertility or fecundity will be based upon the age of the female. It follows from this, that two populations will be (i.) exactly, or (ii.) approximately, comparable, only when the conjugal age-relationships are (i.) sensibly identical, or (ii.) are similar.

<sup>&</sup>lt;sup>1</sup> By Joseph Körösi, see Phil. Trans. Lond. B., 1895, p. 781.

Isogeny will denote either equal fertility or equal fecundity, the former to be called initial isogeny or isoprotogeny; the latter general isogeny, or characteristic isogeny, or simply isogeny.

A curve, passing through a series of pairs of ages plotted as coordinates, in such a manner that it will pass through all ages which give either equal initial or equal general fertility or fecundity, will be called an *isogen* as applied to either. The curves may therefore, in the cases considered, be called *isoprotogens*, and *isogens*.

The terms "fertility" and "fecundity" though ordinarily sensibly identical in meaning, have sometimes been assigned different meanings by statisticians, one being employed to signify the qualitative, and the other the quantitative, aspect of reproductivity.

Owing to their phonic resemblance the words "sterility" and "fertility" are the more appropriate to employ in order to denote the difference between producing or non-producing; while "fecundity," which biologically is used without qualificative to imply producing in great numbers (a meaning which requires the qualification "great" when fertility is used), is obviously the more appropriate word to denote "multiple fertility."

English. French. Italian. German. Danish. Swedish.

Fertility; Fertilité; Fertilità; Fruchtbarkeit or Frugtbarhed Fruktsamhet; Gebarfähigkeit

Fecundity. Fécondité. Fecondità. Ergiebigkeit or Avledygtighed Afvelsamhet.
Fruchtbarkeit

Inasmuch "Fruchtbarkeit," "Frugtbarhed" and "fruktsamhet" ought, if possible, to be appropriated to the one meaning, the first suggestion as regards the German is to be preferred. That is, it is better to adopt "Fruchtbarkeit" for fertility and "Ergiebigkeit" for fecundity.

Körösi suggests "Ergiebigkeit der Ehen." "Mutterschaftsfrequenz" and "Maternitätsfrequenz" refer only to cases of maternity.

<sup>&</sup>lt;sup>1</sup> In Latin, although "fertilitas" and "fecunditas" have no marked difference of meaning, the latter word seems to be the preferable one for denoting frequency of bearing offspring. The root of fecundus is "feo" (obsolete), or FE = Greek  $\phi v$ ; c.f. Sanskrit bhu; Zend bû; see  $\phi \omega \omega$  Liddell and Scott's Greek-English Lexicon, 8 Edit., p. 1703.

The root of "fertilis" is "fero" = Greek root  $\phi\epsilon\rho$ : c.f., Sanskrit "bhar"; Zend "bar"; A.S., "bear-n"; the radical meaning being to bear or carry. See Liddell and Scott op. cit., p. 1662.

In regard to "sterilitas," c.f., Sanskrit "stari" (vacca sterilis). In other languages the following correspondence might be suggested:—

<sup>&</sup>quot;Maternitätsfrequenz" refer only to eases of maternity.

J. Matthews Duncan, in his "Fecundity, fertility, sterility and allied topics," 1866, 2nd Edit., 1871, has used "fecundity" to imply the quality of producing "without any superadded notion of quantity," and "fertility or productiveness" the amount of births as distinguished from the capability to bear." For the reasons indicated in the text, it is better to adopt the terms "sterile" and "fertile" as contrasted, that is, as meaning "non-productive" and "productive" without reference to quantity, and the term "fecund" as conveying the idea of quantity. The matter seems of sufficient importance to abandon Duncan's usage.

Physiological or potential fecundity is, at present, not ascertainable: what is discoverable is only actual fecundity. Both rise to a maximum and fall away, the latter very early in life, while it is improbable that this is true of the former. The difference is theoretically (and of course practically) important. The following definitions make the matter

- (i.) Physiological fecundity at a given age is the probability that a female of that age, subject to a definite degree of physiological risk, uniform for all ages, will reproduce.
- (ii.) Actual fecundity at a given age is the probability that a female of that age, subject to average actual risk (as modified by social traditions, etc., and also by reproduction itself, and not necessarily uniform for all ages), will reproduce.

Inasmuch as physiological fecundity is probably not identical in populations of different races or nations, or even in populations of different localities and times, and is, moreover, dependent upon general health and mode and standard of living, the obtaining of its measure is in a high degree important, though at present impracticable.

Actual fecundity is, naturally enough, different for married and unmarried females. While it does not, even with married females, measure without correction the urgency of the reproductive impulse, or in unmarried females measure the force which this impulse opposes to restrictions created by social environment, it throws, as we shall later see, important light on this question.

- 3. The measurement of reproductive efficiency.—The determination of an unequivocal method of measuring the reproductive efficiency of a population is not without difficulty for the following reasons, viz., that—
  - (a) The life of women varies in duration;
  - (b) The reproductive period is only a limited portion of it;
  - (c) Fertility and fecundity are neither uniform for all ages, nor for all women;
  - (d) It appears to be qualified by the age of the associated males;
  - Marriage and child-bearing initiate at different ages;
  - Reproductive efficiency must take account of the duration of life of the children; and that
  - The exercise of the reproductive function is subject to adventitious influences.

By way of enforcing the penultimate point, it may be noticed that generally a high birth-rate is associated with a high rate of infantile mortality, and the rate measured by taking account only of survivors at the end of one year or other prescribed period may give quite a different indication to that derived from births only. The following outline of various schemes of measurement, some of which have already been dealt with, will indicate the nature and limitations of each.

RATE ME	ASURED BY-	Deduced Result	Remarks.					
Numerator.	Denominator.	known as—						
Total births, B	Total popula- ation, P	Crude birth- rate, B/P	Is dependent on age, sex, and conjugal constitution of total population, and therefore not strictly comparable as between different populations; it measures merely one element determining increase.					
Total births, B	Total female population, F	Birth-rate re- ferred to total number of women, B/F	Is dependent on female population only and is affected of course by the age and conjugal condition of that population.					
Total births, B	Female popula- tion of repro- ductive age (viz., from about 10 to 60), F', say	Birth-rate re- ferred to women of re- productive age only B/F'	Indicates reproductive efficiency of all women within the reproductive period. Owing, however, to the limits of this period being ill-defined at the initial and terminal ages, to the largeness of the number of women at those ages, and to the fact that it is dependent on the age-constitution within the group chosen to represent the reproductive age, the rate is not as definite as is desirable. The denominator, however, is a good crude measure of the potential of reproductive efficiency of the population.					
Births in each age-group, $B_x$	The women in same groups,	Birth-rate referred to women of each age-group in question, $B_x/F_x$	Is uncertain for comparison because the ratio of married to umarried women may vary, and the relative frequency of maternity in each is not identical.					
Nuptial births in each age- group, $B'_x$	Married women in same agegroup, $M_x$	Nuptial mater- nity rate for each age- group, $B'_x/M_x$	Shews only the average frequency of maternity (average probability of maternity) for married women in each age-group.					
Ex-nuptial births in each age- group of un- married women, $B_x$	Unmarried women in age-group, $U_x$	Ex-nuptial maternity rate for each age-group, B"x/Ux	Shews only average frequency of mater- nity (average probability of maternity) for unmarried women in each age-group.					
Appropriately weighted sum of birth-rates of the married and un- married	Unity	Modified "Nuptial Index of Natality"	This attributes the reproductive facts of an existing population to a supposititious "standard" population, in which the re- lative number of married and unmarried females is the general average (norm) for the groups of populations to be compared. The comparison so attained may be re- garded a suitable comparative measure of reproductive efficiency (natality).					

4. Natality tables.—The preceding methods of measuring productive efficiency are all more or less defective. A more satisfactory scheme is to construct a monogenous age-group "natality table" for married, and one for unmarried, females. Such tables shew for each age the probability of the occurrence of a birth and the average number of children per confinement: see hereinafter. This, without doubt, is a more definite method, and stands in much the same relation to statistics of births, as a mortality table does in relation to statistics of deaths. It is, however, not perfectly satisfactory, because, as already indicated, it would appear that the age of the father as well as that of the mother affects the probability of maternity. This will be dealt with hereinafter. Tables of digenous natality, i.e., double-entry tables, shewing the natality for every combination of age, are more complete and exact, and would be perfectly so, if the fertility at any age were unaffected by the number of previous confinements. This, however, is probably not the case. These matters will be dealt with in the various sections and tables hereinafter in this part.

Norm of population for estimating reproductive efficiency and the genetic index. - In order to eliminate the effect of variations in the constitution of populations, it is desirable to establish on as wide a basis as possible the norm of its female conjugal constitution, preferably for every 5 years of the reproductive period. This norm would shew for a total of 1,000, 10,000 or 100,000, etc., women of all reproductive ages, the number aged 10-14, 15-19, . . . . . . . . . . . . . . . . 55-59; that is from the 10th to the 59th year of age inclusive.\* For each age-group there would be (at least) two classes, viz., the "unmarried" which might include widows and divorcées not remarried, and the "married." If, then, to these numbers in the age-groups of the "married" we attribute the nuptial birth-rates\* and compute the births, and to the "unmarried" we similarly attribute the ex-nuptial birth-rates, which are actually experienced by any population considered, we shall have comparable measures; and the aggregate (divided if desired by 1,000; 10,000 or 100,000, etc.) will be the "Index of Natality" based on the women of reproductive age. In short, the birth-rates actually experienced in the various age-groups of females of reproductive ages, for a series of populations to be compared as regards reproductive efficiency, are attributed to a common standard population (the norm). The sums in the various cases are the comparable measures of reproductive efficiency. Symbolically this may be described as follows:-Let  $p_1$  and  $p'_1$ ,  $p_2$  and  $p'_2$ , etc., denote the ratio of the married and of the unmarried respectively in age-groups 1, 2, etc., to the total number of women married and unmarried of reproductive ages in the norm or standard population; that is, to the total of all the reproductive groups of that population. Then the sum  $p_1+p_2+\ldots p'_1+p'_2+\ldots=1$ . Hence the index of natality, v, which measures reproductive efficiency, is simply-

$$(453)..... = \Sigma_{\scriptscriptstyle 10}^{\scriptscriptstyle 59} (p\beta) + \Sigma_{\scriptscriptstyle 10}^{\scriptscriptstyle 59} (p'\beta')$$

where  $\beta$  denotes the nuptial, and  $\beta'$  the ex-nuptial, birth-rate based upon the numbers of the married and unmarried respectively, and not upon the total population of each group. In practice these results may of course for convenience be actually multiplied by 1,000, or any higher number.

This index of reproductive efficiency we shall call the *genetic index*. It is formed in a manner identical with that adopted to determine the index of mortality.

6. The Natality Index.—Following a procedure similar to that dealt with in last section, let  $q_1$  and  $q'_1$ ,  $q_2$  and  $q'_2$ , etc., denote the ratio in the standard population of the married and unmarried‡ respectively to the

<sup>\*</sup> By dividing the nuptial births in each age group by the mean number of married women in that group,  $b_m/M$ .

<sup>†</sup> By dividing the ex-nuptial births in each age-group by the mean number of unmarried women in that group;  $b_n/U$ . When desirable to distinguish them "never married" may be used instead of "unmarried," the latter would include "widowed" and "divorced."

<sup>‡</sup> See preceding note.

total of the standard population. Then these quantities will be smaller than  $p_1$ ,  $p'_1$ , etc., in the ratio of the sum of all females of reproductive age in the standard population to the total standard population, male and female. Hence if we attribute to each age-group-ratio the birth-rate experienced in the population to be compared, we get a total also smaller in the same ratio. This then would give the natality-index  $\nu'$ . That is—

(454)...
$$\nu' = \Sigma(q\beta) + \Sigma(q'\beta') = \frac{P'}{P}\nu$$

where P' denotes the females of reproductive age in the norm, and P denotes the total population, male and female, in the norm.

7. Age of beginning and of end of fertility.—The determination of the age at which fertility begins and ends is of importance, and also the range of the reproductive period, which, of course, may not extend in individual cases from the initial age to the terminal age for a large population. What will be discussed here is the latter. The limits may best be determined from the usual statistical data by considering the nature of the frequency as the limits are approached. Keeping in view the fact that the numbers from which the experience is drawn do not vary appreciably, the absolute numbers may preferably be used for judging the age-terminals We get, therefore, for the old-age limit the following results for the period from 1st January, 1907, to 31st December, 1914, for Australia, the population being nearly 5 millions.

TABLE LXXI.—Probability of Birth in Old-age, Australia, 1907 to 1914.

Age of Mothers Nuptial and Ex-nuptial.	48	49	50	51	52	58	54	55	56	57	58	59	60	Totals.
No. of births in									.					
	322	113	39	13	6	5	3	2	1	1	0	0	0	505
		117.0		3.50								0050		
	319	117.3	43.2	15.9	5.8	2.1	0.8	0,3	0.1	0.04	0.014	.0053	.0020	504.613
	000	110 4	400	10.4	0.0			0.77		0.0		0.000	0.050	- AA - OO
varying rate	322	113,4	42.0	10,4	0.8	3.0	1.4	0.7	0.4	0.2	0.1	0.009	0.053	506.522
Ratio of decrease	2.5	4 2.7	70 2.5	6 2	42 2.	28 2.	14 2.	00 1.8	86 1.	72 1.	58 1.	44 1.:	30	
" Equivalent	`								]				İ	
married women	16020	18105	15119	19000	19750	11716	10010	0040	6060	8071	7280	RRAS	Ango	
	10990	10100	19119	19090	14138	11,10	10019	,9940	0900	9071	1200	0000	0000	
	2 377	877	323	117	59	53	35	25	14	15	0	0	۱ ۵	
	-,517	311	320	111	00	"	00		1.2	10	"	1		
			, 1	}	1	}	1	1	'				1	
	2.377	877	320	117	71	49	35	25	17	10	4	? 2	9 1	
	Nuptial and Ex-nuptial.  No. of births in 8 years Decrease at the rate of ex. Decrease at twarying rate  Ratio of decrease "Equivalent number" of married women Probability per 100,000 Married women of same age.	Nuptial and Ex-nuptial.  No. of births in 8 years Becrease at the rate of e* 319  Decrease at varying rate 322  Ratio of decrease "Equivalent number" of married women Probability per 100,000* Married women of same age	Nuptial and Ex-nuptial.  No. of births in 8 years 322 113 Decrease at the rate of e* 319 117.3 Decrease at varying rate 322 113.4 Ratio of decrease "Equivalent number" of married women Probability per 100,000* Married women of same age	Nuptial and Ex-nuptial.   48   49   50	Nuptial and Ex-nuptial.   48   49   50   51	Nuptial and Ex-nuptial.  No. of births in 8 years . Decrease at the rate of ex . Decrease at the rate of decrease at the rate of decrease at the rate of decrease at the rate of decrease at varying rate . 322 113 39 13 6 15.8 117.3 43.2 15.9 5.8 113.4 42.0 16.4 6.8 Ratio of decrease "Equivalent number" of married women Probability per 100,000* . Married women of same age 16038 16105 15113 13898 12759 130,000* . Married women of same age 17.3 17.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18	Nuptial and Ex-nuptial.  No. of births in 8 years . Decrease at the rate of e* . 319 117.3 43.2 15.9 5.8 2.1 Decrease at the rate of ee* . 322 113.4 42.0 16.4 6.8 3.0 Ratio of decrease "Equivalent number" of married women Probability per 100,000* Married women of same age . 327 877 323 117 59 53	Nuptial and Ex-nuptial.  No. of births in 8 years . Decrease at the rate of e* . 319 117.3 43.2 15.9 5.8 2.1 0.8 Decrease at twarying rate . 322 113.4 42.0 16.4 6.8 3.0 1.4 Ratio of decrease "Equivalent number" of married women Probability per 100,000* Married women of same age   16938 16105 15113 13898 12759 11716 10819   100,000* Married women of same age   2,377 877 323 117 59 53 35	Nuptial and Ex-nuptial.  No. of births in 8 years . Decrease at the rate of e* . 319 117.3 43.2 15.9 5.8 2.1 0.8 0.3 Decrease at twarying rate . 322 113.4 42.0 16.4 6.8 3.0 1.4 0.7 Ratio of decrease "Equivalent number" of married women Probability per 100,000* . Married women of same age	Nuptial and Ex-nuptial.  No. of births in 8 years 322 113 39 13 6 5 3 2 1 Decrease at the rate of e <sup>x</sup> 319 117.3 43.2 15.9 5.8 2.1 0.8 0.3 0.1 Decrease at the rate of e <sup>x</sup> 322 113.4 42.0 16.4 6.8 3.0 1.4 0.7 0.4 Ratio of decrease 322 113.4 42.0 16.4 6.8 3.0 1.4 0.7 0.4 Ratio of decrease 2.84 2.70 2.56 2.42 2.28 2.14 2.00 1.86 1. number of married women Probability per 100,000* Married women of same age	Nuptial and Ex-nuptial.  No. of births in 8 years 322 113 39 13 6 5 3 2 1 1 Decrease at the rate of e* 319 117.3 43.2 15.9 5.8 2.1 0.8 0.3 0.1 0.04 varying rate 322 113.4 42.0 16.4 6.8 3.0 1.4 0.7 0.4 0.2  Ratio of decrease "Equivalent number" of married women Probability per 100,000* Married women of same age	Nu ptial and Ex-nuptial.  No. of births in 8 years 322 113 39 13 6 5 3 2 1 1 0 Decrease at the rate of e* 319 117.3 43.2 15.9 5.8 2.1 0.8 0.3 0.1 0.04 0.014 varying rate 322 113.4 42.0 16.4 6.8 3.0 1.4 0.7 0.4 0.2 0.1  Ratio of decrease "Equivalent number" of married women Probability per 100,000* Married women of same age	No. of births in 8 years . Decrease at the rate of e* . 319 117.3 43.2 15.9 5.8 2.1 0.8 0.3 0.1 0.04 0.014 .0053 Decrease at the rate of e* . 322 113.4 42.0 16.4 6.8 3.0 1.4 0.7 0.4 0.2 0.1 0.069 Ratio of decrease . 2.84 2.70 2.56 2.42 2.28 2.14 2.00 1.86 1.72 1.58 1.44 1. Tumber' of married women Probability per 100,000* Married women of same age	No. of births in 8 years . Decrease at the rate of e* . 319 117.3 43.2 15.9 5.8 2.1 0.8 0.3 0.1 0.04 0.014 0.053 0.020 Decrease at the rate of e* . 322 113.4 42.0 16.4 6.8 3.0 1.4 0.7 0.4 0.2 0.1 0.069 0.053 Ratio of decrease 2.84 2.70 2.56 2.42 2.28 2.14 2.00 1.86 1.72 1.58 1.44 1.30 "Equivalent number" of married women Probability per 100,000* Married women of same age

<sup>\*</sup> Crude result. † Smoothed result, see formula (454).

The above results indicate that towards the end of the child-bearing period the numbers decrease (above 48 years of age) roughly at about the rate  $e^x$ , where x is the number of years; see line 2. This at least holds from 48 to 52, when it would appear that the decrease is much more slow. A closer correspondence can be had by forming the numbers according to a formula varying the rate of decrease such as—

$$(455)....n_{x+1} = \{2.84 - 0.14 (x - 48)\} n_x$$

where  $n_x$  denotes the number of mothers of age x, last birthday.

The figures in line 1 in Table LXXI, are 8 years' experience of nuptial and ex-nuptial births with women of from 48 to 60 years of age in Australia. During this time there were 476 of the former to 26 of the latter, the number of married and unmarried females of the ages mentioned being respectively 136,781 and 21,615, giving one case of maternity in 287.3 and 831.3 women, respectively. The frequency of maternity with unmarried women between the age-limits in question is thus 0.346 that of married women (or that of married women is 2.89 times that of unmarried women). If, therefore, we add to the number of married women 0.346 times the number of unmarried that will be the total "equivalent number" of married women to whom the cases of maternity can be ascribed. These, divided into one-eighth¹ of the numbers on line l, give the crude probabilities of maternity for married women of the ages in question. The values, as calculated from the data, are given in line 6; the smoothed values obtained from these are given in line 7. Although a probability is given for age 58, the actual fact is that in over 7,000 possible cases (see line 5) no birth occurred; 57 is the greatest age at which a birth actually occurred. The values are shewn as curve A and on a larger scale, as curve B on Fig. 66. It will be noted that the continuation of the curve for ages 49 to 51 (see a b) on the figure, suggests that 53 is the age at which the value approaches zero, point c, and the curve for ages, 51 to 60, b d in figure, seems to be quite a different curve. No simple exponential relation, however, will bring these two curves under a single formula.<sup>2</sup> See page 244 for Fig. 66.

For the lower limit we have the following data, viz.:-

TABLE LXXII.—Probability of a Birth in Early Age, Australia, 1907-1914.

Line	Age.	11	12	13	14	15	16	17	18
1	Nuptial births, 8 years	0	0	4	30	170	1,138	4,062	11,761
2	Ex-nuptial births, 8 years	0	5	21	126	537	1,500	2,980	4,504
. 3	Total births, 8 years	О	5	25	156	707	2,638	6,942	14,265
4	Ratio of ex-nuptial to nuptial births	_	∞	5.2	4.2	3.16	1.32	0.73	0.38
5	Married women			1	18	93	349	1,145	2,551
6 7	"Never married" women Probability of nuptial maternity per annum per	42,222	42,001	42,071	42,484	43,273	43,915	43,813	42,854
8	1,000	0	0	? 500	7 208	228	408	443	576
	1,000,000 unmarried women	0	1.6	6.5	37.1	155.1	427	850	1,313

<sup>&</sup>lt;sup>1</sup> Approximately, see § 8, p. 240.

$$n_{x+1} = \{2.75 - 0.15 (x-48)\} n_{x}$$

would be in substantial agreement with (455), and are as follows:-

2377 864 332 136 59 27 14 7 4 3 2 1

They are less probable, however, than these given on line 7 in the table.

<sup>&</sup>lt;sup>2</sup> Results deduced from the initial value 2377 by means of the formula—

The results on line 8 do not need smoothing. Those on line 7 for the ages 13 and 14 are, of course, very uncertain, the normal values would probably be much smaller than 200. It is evident from the above, that the cases of ex-nuptial maternity throw most light upon the question of the commencing age of fertility. These are shewn on line 2, and will be given very nearly by the equation.

$$(456)\ldots n_{x-1} = \{1.50 + 0.50 (18-x)\} n_x.$$

The results are shewn as curve D, and on a larger scale as curve E, on Fig. 66, on page 244.

The general result of the investigation as to the terminal conditions is that the null-points can be taken as say 11 and 60, the values being very small from ages 53 onward, and from 11 to 12.2 The initial null-point is consistent with the curve of frequency of the first menstrual appearance, which would give a null-point of about 9 years<sup>3</sup> and a maximum just after 16 years of age are attained. The curve as shewn in Fig. 66, curve C, gives, according to Whitehead, the group-numbers of single year agegroups for a total of 4,000 cases under observation. These group-numbers are shewn by small circles, see p. 244.

8. The maternity-frequency, nuptial and ex-nuptial, according to age, and the female and male nuptial-ratios.—Let g, m, and u, denote respectively the number per annum (i.) of brides, (ii.) cases of nuptial maternity; and (iii.) cases of ex-nuptial maternity, and also let M and U denote the number of married and "never married" women among whom the latter occur. These numbers are given for each age from 12 inclusive onward, in Table LXXIII., see columns (ii.), (iii.), (iv.), (vi.), and (vii.), or g, m, u, M and U.

The numbers are for 8 years, and the mean population from which they are drawn is about 8.0406 times that of the moment of the Census, viz., 3rd April, 1911. Hence the epoch can be regarded as the date of the Census, and the numbers have been divided by 8.0406 to obtain the annual equivalent.

 $<sup>^1</sup>$  If we take 4500 as the number of ex-nuptial births for the age 18, we shall obtain 4.0, 27.7, 145.6, 545.8, 1500.3, 3000.0, and 4500, instead of the numbers shewn on line 3 in Table LXXII.

<sup>&</sup>lt;sup>2</sup> At Budapest, J. Körösi records two mothers at 54, one at 56, and one at 57 in 4 years; vide, Phil. Trans. 1895, B., p. 794. In Edinburgh and Glasgow Matthews Duncan records for the ages 51, 52 and 57, and for an aggregate of 16,301 married mothers, 2, 4 and 1 respectively, p. 9 of his "Fecundity, Sterility, &c." 1871 Edit. C. Ansell in 1874, vide his "Statistics of Families," regards an alleged case at 59 as needing verification. Tauffer, of Budapest, in 2083 cases, records one at 54. In handbooks of Forensic Medicine, Casper-Liman mentions one case at 54; one is mentioned by Hofmann at 55; see Phil. Trans. loc. cit. C. J. and J. N. Lewis' "Natality and Fecundity," published 1906, out of 84,971 cases of births in Scotland in 1855, give for the ages 15, 16, 17 and 50 and upwards to 58; the following results, viz.:—

Ages 15. 16. 17; 50. 51. 52. 53. 54. 55. 56. 57. 58. Numbers 3. 23. 132; 16. 5. 7. 1. 3. 2. 1. 1. 2.

<sup>&</sup>lt;sup>3</sup> See "Sterility and Abortion," Whitehead, p. 46, or M. Duncan, op. cit., p. 32.

The ratio (e) of ex-nuptial to nuptial cases of maternity is found by dividing the values in column (iv.) by those in column (iii.) in Table LXXIII. That is to say-

$$(457)\ldots e = u / m.$$

The ratio of "brides" to "unmarried" females, or to females " never married " given in column (viii.) of the table, may be called the "female nuptial ratio" (a) according to age, and is given by-

$$(458)...g = g/U$$

the total number of brides being the same as the number of marriages Jin (400), p. 176. Suffixes will denote the age to which the ratio refers. The values a are the probabilities of marriage according to age of the unmarried. This probability corresponds to a mean of the marriagerates of 0.008403, and to a marriage rate over all the eight years of  $0.00842863.^{1}$ For any particular year the distribution according to age will therefore approximately be in the ratio of the crude marriage rate for the year in question to that above; expressed ordinarily, say as-

$$(459)...g' = \frac{g}{U}.\frac{n}{0.00843}$$

n being calculated as indicated by (400), p. 176.

The greatest number of never married appears to be for the year between the ages 16.32 to 17.32, the number being about 43,950. Similarly the greatest number of brides appears to be for the ages 21.90 to 22.90, the number being about 27,955.

The curve shewing the number of brides of each age is curve F, Fig. 67, and that shewing the number of the females "never married" is curve G of the same figure; G' and G'' shew the terminal values on a larger scale. The circles with crosses denote the positions of the data when corrected for the error of statement of age at marriage; see pp. 193-6 hereinbefore. The crude results are shewn by circles on E', G, G' and G''. It will be seen from these terminal values that there is considerable regularity in the curve even for advanced ages (see p. 244).

The "male nuptial ratio," according to age, is, similarly to (458) and (459)—

$$(460).....\mathfrak{v} = v / V$$
; or  $(461)....\mathfrak{v}' = \frac{v}{V} \cdot \frac{n}{0.00843}$ 

The values are given in Table LXXIII., the crude results being shewn in column (xiv.). The curve shewing the number of bridegrooms of each age is curve W, Fig. 70, and that shewing the unmarried males is curve V of the same figure. V' and V'' shew the terminal values on a larger scale. The smoothed values of the probability g', and u' are given in columns (xviii.) and (xix.) of Table LXXIII.

<sup>&</sup>lt;sup>1</sup> Expressed per thousand, as is usual, 8.42863.

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TABLE LXXII.—Shewing the Numbers of Brides and Bridegrooms and the Cases of Nuptial and Ex-nuptial Maternity during the Years
1907-1914, Australia, and the Numbers of Married and Never Married Males and Females, at the Census of 3rd April,
1911. Shewing also the Probabilities of Marriage for Never Married Males and Females, and the Probability of Nuptial
and Ex-nuptial Maternity. and Ratios Dependent upon these.

	and Ex-nuptial Maternity, and Ratios Dependent upon these.																	
Age at Maternity.	Brides during 1907-1914 (g).	Cases of Nuptial Maternity (m).	Cases of Ex-nuptial Maternity $(u)$ .	Ratio of Ex-nuptial to Nuptial Cases $u/m$ .	Married Women Census, $1911 \ (M)$ .	Women Never Married Census, 1911 ( U).	Ratio of Brides per annum to the Number Unmarried $(g=g/U)$ .	Grude Rate of Nuptial Maternity (per annum) $(p = m/M)$ .	Crude Rate of Ex-nuptial Maternity (per annum) $(n = u/U)$ \$	Ratio of Crude Ex-nuptial to Crude Nuptial Maternity Rate = $c = u/D + m/M$ .	Number of Bridegrooms 1907-1914 (v).	Men never Married Census, 1911 (V).	Ratio of Bridegrooms per Annum, to the Number Unmarried $v = (v/V)$ .	Probability of Nuptial . Maternity, Smoothed v'	Probability of Ex-nuptial Maternity (Smoothed) u'§	Ratio of Probability of Exnuptial Maternity to Nuptial Maternity to	Probability of Marriage of Women (Smoothed) g'.	Probability of Marriage of Men (Smoothed) u.
(i.) 12 13 14 15 16 17 18	(ii.) 1 ·4 73 489 2,412 6,918 13,246* 18,140*	(iii.) 0 4 30 170 1,140 3,974 9,796 18,165	126 538	.4613	18 93 349 1,145 2,551	(vii.) 42,001 42,071 42,284 43,273 43,915 43,813 42,854 41,020	.01964  .03844	.497 .207 .227 .4062 .4316 .4776 .5022	(x.) .000015 .000062 .000371 .00155 .00425 .00849 .01311 .01619	.0018 .0068 .0105 .0197 .0275 .0322	4 51 239 1,205 3,353	46,470	.000140 .000643 .00321 .00897	(xv.) .: .2070 .2270 .3010 .4580 .4835† .4790	(xvi.) .000015 .000062 .00037 .0016 .0042 .0085 .0131	(xvii.)  .0018 .0071 .0109 .0187 .0271 .0325	(xviii.) .00000024 .0000095 .000215 .00141 .00683 .01964 .04064*	
20 21 22 23 24 25 26 27 28	20,231* 32,673* 27,950 26,402 23,903 20,707 17,731 14,440 12,372 10,010	25,307 35,529 43,607 50,655 53,569 54,712 55,453 54,229 53,753 49,739	5,302 5,040 4,267 3,878 3,208 2,567 2,181 1,812 1,719 1,417	.0978 .0765 .0599 .0469 .0393 .0334	10,100 13,047	30,878 26,360 22,725 19,600 17,267 15,370 13,646	.11733 .11258 .12457 .13082 .13139 .12771 .11684 .11276	.4540 .4375 .4157 .3813 .3524 .3290 .3190 .3041 .2960 .2717	.01719 .01810 .01729 .01830 .01756 .01629 .01571 .01466 .01567	.0379 .0414 .0413 .0480 .0498 .0495 .0492 .0482 .0529 .0534	6,438 17,374 19,977 23,655 24,918 24,650 23,494 21,011 19,384 16,113	45,466 43,799 41,097 37,541 34,003 30,338 26,823 23,597 20,808 18,677	.0176 .0493 .0605 .0784 .0911 .1011 .1089 .1107 .1159 .1078	.4640 .4425 .4157 .3813 .3524 .3330 .3190 .3071 .2930 .2735	.0172 .0180 .01835‡ .0181 .0176 .0169 .0160 .0154 .0149 .0146	.0368 .0407 .0446 .0474 .0497 .0500 .0510 .0512 .0515 .0527	.07674* .09706* .11966 .12544 .12623 .12613 .12407 .11867 .11376 .10202	.01760 .04930 .06050 .07840 .09110 .10110 .10890 .11270 .11270 .10850
30 31 32 33 34 35 36 37 38	8,405 5,847 5,558 4,342 3,854 3,521 2,914 2,438 2,369 2,005	48,535 40,683 42,093 37,934 34,848 31,794 29,895 26,632 25,044 21,116	1,373 861 969 827 792 705 648 551 564 441	.0212 .0230 .0218 .0227 .0222 .0217 .0207	22,784 22,726 22,542 22,421 22,059 21,700 21,350 21,000 20,560 20,215	10,839 9,659 8,730 7,835 7,278 6,791 6,319 5,910 5,630 5,303	.05130 .05233	.2649 .2226 .2322 .2104 .1965 .1822 .1741 .1577 .1515 .1299	.01575 .01109 .01380 .01313 .01353 .01291 .01275 .01160 .01246 .01034	.0594 .0498 .0594 .0624 .0689 .0708 .0732 .0736 .0822 .0796	13,392 10,349 9,745 7,712 6,796	16,700 14,875 13,250 11,925 10,900 10,177 9,529 9,032 8,613	.0997 .0865 .0915 .0804 .0775 .0741 .0698	.2560 .2415 .2250 .2104 .1965 .1850 .1741 .1635 .1485 .1299	.0143 .0140 .0137 .0135 .01325 .0130 .0127 .0122 .0115 .01045	.0548 .0569 .0606 .0643 .0673 .0699 .0726 .0748 .0788	.09200 .08348 .07620 .07014 .06492 .06008 .05584 .05205 .04861 .04572	.10150 .09270 .08600 .08100 .07630 .07250 .06980 .06550 .06120 .05300
40 41 42 43 44 45 46 47 48	1,688 1,126 1,287 1,005 948 946 712 663 654 493	17,255 12,425 11,138 7,542 4,783 2,776 1,399 688 311 106	389 204 205 156 86 58 37 17 12	.0225 .0164 .0184 .0207 .0180 .0209 .0264 .0247 .0386 .066	19,851 19,457 19,026 18,453 18,040 17,554 17,064 16,554 15,975 14,216	4,987 4,623 4,226 3,940 3,707 3,441 3,212 3,000 2,783 2,570	.0303 .0379 .0336 .0318 .0343 .0276	.1081 .0794 .0728 .0508 .0330 .01967 .01020 .00517 .00242 .00087	.00970 .00549 .00603 .00492 .00289 .00210 .00143 .00070 .00054	.0897 .0691 .0828 .0968 .0877 .107 .140 .135 .223	3,252 2,336 2,447 2,058 1,745 1,575 1,350 1,363 1,146	$\frac{7,077}{6,763}$	.0296	.1081 .0870 .0670 .0495 .0330 .0197 .0102 .0052 .0025	.0095 .0076 .0059 .0043 .0030 .0020 .0012 .00085 .00055	.0833 .0817 .0820 .0860 .0909 .100 .133 .170 .220 .283	.04263 .03999 .03763 .03540 .03330 .03133 .02999 .02828 .02670 .02525	.04660 .04195 .03980 .03770 .03570 .03395 .03245 .03100 .02960
50 51 52 53 54 55 56 57 58 59	481 308 351 238 228 179 189 165 159	34 12 7 4 3 2 1 1	5 1  1 	.147	14,303 13,162 12,088 11,100 10,286 9,468 8,557 7,675 6,912 6,293	2,340 2,127 1,938 1,780 1,549 1,363 1,248 1,145 1,032	.0256 .0180 .0225 .0166 .0191 .0163 .0188 .0179 .0192	.00030 .00011 .00007	.00028	.933 .545 1.750 	1,113 740 579 647 621 545 489 400 419 286	5,232 4,797 4,332 3,942 3,642 3,342 3,042 2,762 2,512 2,302	.0265 .0192 .0228 .0204 .0212 .0203 .0200 .0180 .0207 .0155	.0008 .0003 .00015 .00007 .000035 .000017 .000008 .000004 .000002	.00022 .00012 .00004 .00002 .00001	.367 .400 .27 .29 .29	.02393 .02274 .02166 .02067 .01975 .01888 .01810 .01735 .01659 .01582	.02695 .02565 .02435 .02300 .02175 .02067 .01967 .01876 .01787
60 61 62 63 64 65 66 67 68	136 58 93 81 68 93 60 54 51			:::::::::::::::::::::::::::::::::::::::	5,746 5,277 4,871 4,505 4,161 3,829 3,502 3,194 2,880 2,621	650 600 550 500 450	.0095 .0162 .0146 .0130 .0193 .0136				347 236 227 229 203 219 170 163 154 122	2,152 2,032 1,922	.0201 .0144 .0147 .0156 .0146 .0168 .0142				.01504 .01425 .01345 .01270 .01200 .01135 .01075 .01019 .00965 .00912	.01615 .01532 .01451 .01372 .01295 .01220 .01147 .01078 .01013 .00952
70 71 72 73 74 75 76 77 78 79	36 21 21 14 11 10 4 6 6				2,365 2,099 1,867 1,652 1,444 1,224 1,004 818 650 510	360 320 280 240 205 180 155 135 120	.0124 .0082 .0093 .0073 .0067 .0069 .0032 .0055 .0062				134 70 70 77 64 53 33 33 22 23	1,230 1,190 1,140 1,080 1,010 920 810 690 560	.0135 .0073 .0076 .0089	::			.00860 .00809 .00759 .00712 .00667 .00623 .00580 .00535 .00496	.00895 .00842 .00794 .00749 .00710 .00675 .00644 .00614 .00585 .00557
80 81 82 83 84 85 86 87 88	2 1 3 1 0 0 0 0				397 317 241 184 140 105 80 56 35 24	92 80 69 58 48 38 28 20 14	.0027 .0016 .0054 .0021				28 10 9 8 7 5 3 3	370 312 266 225 189 158 121 90	.0094 .0040 .0042 .0044 .0046 .0039 .0031 .0041 .0019				.00418 .00380 .00344 .00308 .00265 .00243 .00213 .00185 .00159 .00135	.00530 .00504 .00479 .00455 .00432 .00410 .00389 .00369 .00350 .00332
90 91 92 93 94 95 96 97 98 99	0 0 0 0 0 0 1 0 0 0				20 16 12 9 7 6 5 4 3 2	86432211111	.062				0 0 0 0 0 1 0 0	33 26 20 15 11 8 6	 .0168  0416				.00113 .00093 .00075 .00059 .00045 .00083 .00022 .00012 .00005	.00315 .00299 .00284 .00270 .00257 .00245 .00234 .00224 .00215 .00207
				Uns	pecified			cluding	the Unsi	pecified	73 301.925		or notes	see next j	na.ge		.00001	

9. Nuptial and ex-nuptial maternity and their frequency-relations.-The crude rate, according to age, of nuptial and of ex-nuptial maternity is found by dividing the number of cases of maternity of each kind by the number of married or of "unmarried" or "never married" women. That is to say p, n, and A denoting the probability of maternity, according to age, respectively of the married, the never married, or of both combined, we shall have:-

$$(462).....\mathfrak{p} = m / M;$$
  
 $(463)....\mathfrak{p} = u / U;$   
 $(464)....\mathfrak{p} = (m + u) / (M + U).$ 

The relation, according to age, between the ex-nuptial and nuptial rates, is-

$$(465)\ldots e = \mathfrak{n}/\mathfrak{p} = \frac{u}{U}/\frac{m}{M} = \frac{M}{m} \cdot \frac{u}{U}$$

These crude rates and their ratio to each other are given in Table LXXIII. for the whole reproductive period in columns (ix.), (x.) and (xi.). The smoothed values are given in columns (xv.), (xvi.) and (xvii.).

The graphs of the numbers of cases of nuptial and of ex-nuptial maternity are shewn respectively by curves H and I, on Fig. 68, the dots in the former case, and the crosses in the latter, denoting the crude results. The ratio of the ex-nuptial cases to the nuptial cases are shewn by curve J, and on a larger scale by curve J,' Fig. 68. The nuptial and ex-nuptial maternity-rates are shewn on the same figure by curves K and L, the dots in the former, and the small circles in the latter indicating the crude results (see p. 244).

It should be noted that m and M in (462), etc., are not necessarily homogeneous, since each will contain, though in unequal proportions, primiparous and multiparous women, and these will have been subject to risk for unequal periods. Moreover the multiparæ may have given birth to very different numbers of children. If, therefore, the probability of maternity is affected by previous issue, the value of p must be regarded as merely a crude probability. An exact probability would have to be defined in categories according to the age, the number of previous issue, and the length of exposure to risk. This will appear more clearly in the theory of fertility and sterility. For this reason the values given of p and u in Table LXXIII, are for the "average risk" of the "average married woman" or the "average never married woman" during twelve months, and takes no account of variation of the "risk" according to the age of the husband. In section 11 hereinafter it will be seen that the maxima vary.

Notes to Table LXXIII. on preceding page.

<sup>\*</sup> If the corrections referred to in Part XII., § 15 and 16, pp. 193-6, be applied, these numbers become 14,004; 19,580; 23,678; 26,927; see formula (407). This will change the ratios in column (viii.) from .03844 to .04064; .05500 to .05937; .06557 to .07674; and .11733 to .09706. † The maximum is for the central age 18.73, that is for the group of ages 18.23 to 19.23, and the amount is 0.4849.

<sup>‡</sup> The maximum is for the central age 22.50; that is for the group of ages 22.00 to 23.00, and the amount is 0.01835.

The ex-nuptial births are attributed to the "never married," but may, perhaps, be equally well attributed to the "unmarried," that is the "never married" together with the "widowed" and "divorced."

## Terminal Frequencies of Fertility; Frequency of Nuptial and Ex-nuptial Maternity; Probability of Marriage of both Sexes at each Age; etc.

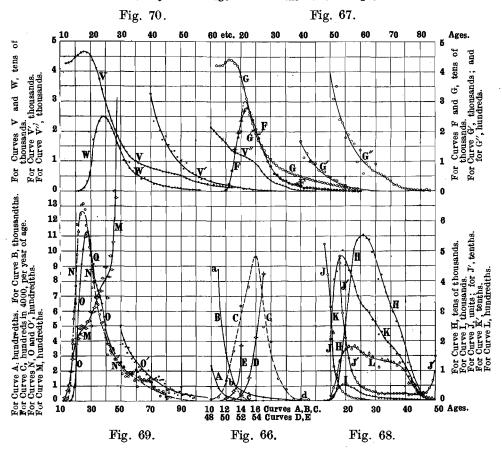


Fig. 66.—Curves A and B shew the terminal age of fertility. Curves D and E shew the initial age of fertility. Curve C shews the frequency of the appearance of menstruation according to age.

Fig. 67 —Curve F shews the numbers of brides at various ages. Curves G, G' and G'' shew the numbers of the "never married" at various ages.

Fig. 68.—Curve H shews the number of cases of nuptial maternity, and Curve I those of ex-nuptial maternity at each age. Curves J and J'shew the proportion of ex-nuptial to nuptial cases of maternity at each age. Curve K shews the nuptial and L the ex-nuptial rates of maternity at each age, the ex-nuptial rate being determined by attributing the births to the "never married".

Fig. 69.—Curve M shews the ratio of the ex-nuptial to the nuptial rates of maternity at each age. Curve N is the ratio of the brides at each age to the "never married females" of the same ages. Curves O and O' are similarly the ratio of the bridegrooms at each age to the "never married males" of the same ages, curve O' being displaced one division (10 years) to the right so as not to be confused with curve N.

Fig. 70.—Curve W shews the number of bridegrooms of each age, and V, V' and V'' the number of "never married males" at each age.

In all the above cases the age is the "age last birthday."

10. Maximum probabilities of marriage and maternity, etc.—The position and amount of the maxima determined from the smoothed results in columns (xv.) to (xix.) of Table LXXIII. are as follow:

Table LXXIV.-Maximum Probabilities, Marriage and Maternity.

Maximum probability of-	Year-gr Age.	oup f	rom— Age.	Amount.
Nuptial maternity	 18.45		19.45	.0486
Ex-nuptial maternity	 22.00		23.00	0.01835
Ratio of ex-nuptial on nuptial .	Probably	no n	naximum	value point of
maternity	in flexi			F
	25	to	26	0.0510
Marriage of women	 24.52	to	25.52	0.12632
Marriage of men	 27.5	to	28.5	0.11320

The maxima are for the two heterogeneous groups "nuptial" and "ex-nuptial" aggregated according to age merely. In the next section it will be shewn that the maxima are dependent upon age at marriage.

The largest number of marriages of brides would appear to be for the ages 21.9 to 22.9, and to be about 28,000 in 8 years; and the largest number of marriages of bridegrooms, for the ages 24.8 to 25.8, the number being about 25,000 in 8 years, the total mean population aggregated for the years in question being 35,821,000 persons. The largest number of cases of nuptial maternity occurred for ages 26.12 to 27.12, the number being about 55,500 in 8 years, and the ratio at the crude maximum consequently 0.3182. The largest number of cases of ex-nuptial maternity occurred for the ages 19.5 to 20.5, the number being about 5,400 in 8 years, and the ratio at the crude maximum of cases, therefore, 0.01691.

The question of a more accurately defined maximum will be considered hereinafter.

11. Probability of a first-birth occurring within a series of years after marriage.—To determine the variation of initial fertility with age, the initial probability of maternity may be deduced by ascertaining primarily the number of women at different ages who were married during a given period. Then, tracing these through the first portion of their married life, the respective periods which elapsed after marriage before they gave birth to their first living child may be ascertained.

For this purpose the six-year period, 1909-14, was brought under observation, the experience being all cases in the Commonwealth of Australia within a series of years, viz., 6 after marriage. Owing to misstatements regarding age, however, the number of brides registered at each age during the several years under observation required correction. It was found that, if the actual numbers of brides registered at ages 18, 19, 20 and 21 years were accepted, without adjustment, anomalous results would be obtained. Evidently serious errors existed owing to brides of 18, 19, and 20 years overstating their age as 21, and therefore the numbers of brides upon which the rates of fertility should be founded needed correction. A special type of smoothing of the number of brides of 18, 19, 20 and 21 years to remedy the misstatement of age had therefore to be adopted.<sup>1</sup>

A similar misstatement of age had evidently occurred in the case of mothers (registered as being 19, 20, and 21 years of age), who gave birth to a first-born child during the period 1909-14, and the numbers consequently had also to be smoothed, so as to eliminate the effect of misstatements in the age of mothers.<sup>2</sup>

Tables were compiled shewing the mean number of brides of each age in any year and in the year immediately preceding; and for the same ages the number of first confinements in successive years of duration of marriage. Assuming then that the migration elements balanced each other, the table gave a series of results shewing for the years 1909 to 1914 inclusive the aggregate number of brides of each age at marriage to which the aggregate number of first confinements could be referred, hence the ratio of the latter to the former gave the probability required.<sup>3</sup>

<sup>&</sup>lt;sup>1</sup> The justification for this smoothing is really that the probability of a misstatement of age is very great, and the probability of some physiological or other cause, for the anomaly, is relatively negligible.

2	The following	are the	unadjusted	and ad	justed figures :	
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Age.	cessi	ial Firs ve Year	t Birth s of Du	s, acc ration	ording after	to s Marri	Suc- age.	Nun	be asc	ribed,	accord	om the ing to ser Mar	Succes	
	Total	0–1	1-2	2–3	3-4	4~5	5-6	Total	0-1	1-2	2-3	3-4	4-5	5-6
18	7,568 7,568		1,291 1,291	262 262	81 81	29 29	6		10,159 10,736		6,513 6,880	4,735 5,003		1,484 1,571
19	11,625 $11,228$	9,071	1,943 1,877		118 114	48	16 16	13,838	13,838 14,902	11,364		6,463 6,917	4,156 4,457	1,998 2,177
20	14,400	$10,141 \\ 10,741$	$\frac{2,618}{2,773}$	556 589	202 214	56 59	23 24	18,100	15,496 18,100	14,860	11,630		4,657 5,475	$2,241 \\ 2,675$
21	17,507 17,100	12,613 12,320	3,699 3,613	823 804	262 256	81 79	29 28		24,850 20,600				7,498 6,264	3,702 3,002

The upper number is that furnished by the registration records, the lower is that which was obtained after adjustment. The only adjustment deemed essential as a preliminary is for these ages, viz., 18 to 21. For all other ages the results are as given by the unadjusted data.

<sup>&</sup>lt;sup>3</sup> The following illustration of the method of compiling will suffice:-

			_ <del>_</del>						7			
Year.	Age at Mar-	Mean No. of Brides for Year	cessiv	ber of l e Year	First Co s of Du	nfinem ration (	ents in of Marri	suc- iage.	Du	ration of	Marriage	, 0-1.
	riage.	and pre- ceding Year,	0-1	1-2	2-3	3-4	4-5	5-6	Age.	Brides.	Confine- ment.	Ratio.
1909	26 27	1,864 1,563	1,002 835	443 417	160 107	71 66	54 39	15 22	26 13,637 7,279 27 11,054 5,721 Duration of Marriage, 1-			
									Du	ration of	Marriage,	1–2,
1910	26 27	2,076 1,616	1,047 853	551 444	219 149	79 73	46 41		26 27	11,068 9,004	3,095 2,566	0.2795 0.2850
			{			,			Du	ration of	Marriage,	2–3.
1911	26 27	2,268 1,781	1,171 967	645 527	212 178	101 88		.,	26 27	8,571 6,971	800 619	0,09 <b>33</b> 0,0888
	(Fron	n these th	e totals	on the	right w	ere for	ned.)	1			,	

The probabilities so ascertained are shewn on Table LXXV. up to 6 years. The crude results are shewn by the dots on Fig. 71, on which the curved lines give the smoothed results, the corresponding numerical values appearing on the right hand side of the table.

TABLE LXXV.—Probability of a Nuptial First Birth occurring within 6 Years of Marriage, Based on Australian Data, 1909 to 1914.

CRUDE RESULTS.

ADJUSTED RESULTS.

Age last	Pro	babilit for a	y of Giv Dura	ving Bir tion of	th to a Marria	First C ge of—	hild	Prob	ability a ]	of Givii Duratio	ng Birth n of Ma	to a Fi arriage	irst Chi of	ld for	Age last
Birth- day.	less than 1 yr.	1-2 yrs.	2-3 yrs.	3–4 yrs.	4-5 yrs.	5-6 yrs.	less than 6 yrs.	than 1 yr.	0-1 yrs.	1-2 yrs.	2-3 yrs.	3-4 yrs.	4–5 yrs.	5-6 yrs.	Birth- day.
11 12 13 14					•••			.0000 .1308 .2568 .3781	.0000 .0963 .1881 .2755	.0000 .0217 .0433 .0647	.0000 .0066 .0131 .0195	.0000 .0030 .0060 .0091	.0000 .0020 .0039 .0058	.0000 .0012 .0024 .0035	11 12 13 14
15 16 17 18 19	.3324 .4352 .4979 .5495 .5879	.1233 .1042 .1271 .1467 .1535	.0470 .0424 .0413 .0381 .0433	.0353 .0177 .0128 .0162 .0165	.0278 .0149 .0141 .0090 .0103	.0075 .0053 .0038 .0073	.6219 .6985 .7633 .8188	.4946 .6063 .6975 .7770 .8414	.3585 .4370 .4985 .5485 .5800	.0860 .1073 .1263 .1455 .1664	.0258 .0321 .0377 .0432 .0497	.0121 .0150 .0176 .0199 .0229	.0076 .0093 .0108 .0123 .0138	.0046 .0056 .0066 .0076 .0086	15 16 17 18 19
20 21 22 23 24	.5934 .5981 .5919 .5800 .5545	.1866 .2144 .2301 .2425 .2466	.0506 .0611 .0675 .0783 .0827	.0253 .0267 .0299 .0314 .0344	.0108 .0127 .0151 .0173 .0231	.0090 .0093 .0122 .0094 .0130	.8757 .9223 .9467 .9589 .9543	.8856 .9176 .9429 .9619 .9730	.5950 .5958 .5908 .5819 .5688	.1854 .2051 .2247 .2423 .2569	.0551 .0614 .0673 .0730 .0785	.0252 .0280 .0306 .0331 .0354	.0153 .0168 .0182 .0195 .0206	.0096 .0105 .0113 .0121 .0128	20 21 22 23 24
25 26 27 28 29	.5314 .5338 .5176 .5037 .4548	.2636 .2795 .2850 .2677 .2774	.0815 .0933 .0888 .1013 .0836	.0375 .0404 .0458 .0465 .0359	.0235 .0254 .0252 .0260 .0198	.0158 .0081 .0141 .0126 .0107	.9533 .9805 .9765 .9578 .8822	.9771 .9750 .9667 .9530 .9330	.5533 .5357 .5168 .4967 .4766	.2679 .2754 .2795 .2813 .2792	.0831 .0872 .0903 .0922 .0929	.0378 .0402 .0423 .0439 .0446	.0216 .0225 .0233 .0240 .0245	.0134 .0140 .0145 .0149 .0152	25 26 27 28 29
30 31 32 33 34	.4686 .4602 .4191 .4057 .3310	.2421 .3084 .2464 .2422 .2526	.0898 .1003 .0873 .0825 .0928	.0498 .0447 .0368 .0428 .0353	.0224 .0238 .0220 .0217 .0232	.0107 .0178 .0132 .0194 .0204	.8834 .9552 .8248 .8143 .7553	.9075 .8745 .8381 .7938 .7411	.4545 .4310 .4073 .3789 .3487	.2751 .2668 .2571 .2463 .2319	.0930 .0923 .0907 .0883 .0843	.0448 .0446 .0440 .0426 .0407	.0247 .0245 .0240 .0231 .0217	.0154 .0153 .0150 .0146 .0138	30 31 32 33 34
35 36 37 38 39	.3036 .3024 .2241 .1919 .1844	.1950 .1820 .1910 .1576 .1391	.0771 .0724 .0741 .0634 .0406	.0387 .0395 .0341 .0252 .0275	.0113 .0236 .0173 .0105 .0087	.0155 .0061 .0000 .0144 .0000	.6412 .6260 .5406 .4630 .4003	.6748 .6063 .5367 .4662 .3946	.3123 .2768 .2423 .2088 .1755	.2135 .1935 .1730 .1520 .1303	.0784 .0718 .0650 .0573 .0490	.0382 .0354 .0315 .0276 .0237	.0198 .0178 .0157 .0134 .0110	.0126 .0110 .0092 .0071 .0051	35 36 37 38 39
40 41 42 43 44	.1436 .1323 .0756 .0669 .0384	.0986 .0870 .0627 .0665 .0462	.0520 .0336 .0211 .0131 .0064	.0131 .0194 .0135 .0051 .0030	.0049 .0076 .0000 .0000 .0000	.0000 .0000 .0073 .0083	.3122 .2799 .1802 .1599 .0940	.3245 .2558 .1951 .1411 .0937	.1426 .1111 .0855 .0634 .0441	.1082 .0863 .0656 .0474 .0321	.0415 .0333 .0254 .0178 .0116	.0198 .0158 .0119 .0080 .0041	.0088 .0070 .0053 .0037 .0014	.0036 .0023 .0014 .0008 .0004	40 41 42 43 44
45 46 47 48 49	.0258	.0066	.0086	.0000	.0000	.0000	.0410	.0622 .0400 .0252 .0159 .0095	.0296 .0199 .0131 .0093 .0062	.0220 .0147 .0094 .0056 .0029	.0070 .0035 .0019 .0007 .0003	.0022 .0012 .0005 .0002 .0001	.0012 .0006 .0003 .0001 .0000	.0002 .0001 .0000	45 46 47 48 49
50 51 52 53 54 55	.0026	.0031	.0000			.0000	.0057	.0053 .0028 .0013 .0006 .0002 .0001	.0040 .0023 .0011 .0005 .0002	.0012 .0005 .0002 .0001 .0000	.0001	.0000			50 51 52 53 54 55

The probabilities in the table apply to the total number of women married at the given ages, not to the survivors after the series of years under observation. The probabilities are of course cumulative, that is to say

the probability,  ${}_{0}p_{n}$ , that a first birth will occur before the end of the n-th year after marriage, is the sum of the probabilities that it will occur during the first, during the second, etc., up to and including the n-th year. Or

$$(466)....p_n = {}_{0}p_1 + {}_{1}p_2 + ...._{n-1}p_n$$

12. Maximum probabilities of a first birth.—From the smoothed results in the table, it will be seen that, as the interval to the first birth increases, the age of maximum increases. Thus the greatest probability of a first birth within the first year from marriage is for age at marriage 21.24, during the year succeeding that of marriage it is at age 28.47, and so on as shewn in the following table, viz., LXXVI.

TABLE LXXVI.—Shewing the Age of Maximum Probability of a First Birth.

Australia 1909-1914.

Interval Years.	0-1	1-2	2-3	3-4	4-5	5–6	0-1	0-2	0-3	0-4	0–5	0-6	0-7*	0-8	0-9	0-10	* 0–11
Corresponding to	20.74	27.97	29.62	29.75	30.03	30.14	20.74	23.75	24.52	24,91	25.06	25,16	25,22 †	25.26	25.30	25.32	25.33 †
Median Age at Marriage Or to Median Age	21.24	28.47	30.12	30.25	30.53	30,64	21.24	24.25	25.02	25.41	25,56	25.66	25,72	25.76	25.80	25.82	25.83
at Birth	21.74	29.97	32.62	33.75	35.03	36.14	21.74	25.25	26.52	27.41	28,06	28.66	29.22	29.76	30.30	30.82	31.33
Probability	.5962	.2813	.0931	.0448	.0247	.0154	.5962	.8259	.9050	.9421	.9637	.9772	.9859	.9916	.9953	.9978	.9998
By Formula (467)	•••			٠.		••		.840	. <b>92</b> 0	.947	.960	.968	.973	.977			

<sup>\*</sup> The ratios 9050/8259, 9421/9050, etc., are 1.0958, 1.0410, 1.0229, 1.0140, which continued, are 1.0089, 1.0058, 1.0038, 1.0025, 1.0020, the factor of the last two figures converging to 52/80. This, however, would give 1.0011 for 0-11. It is more probable, however, that the probability is of the type  $_0p'_{n+1} = (_0p'_n + m)/(1+m)$  where m may perhaps be taken even as unity, implying that the residual chance is reduced about one half each year. The matter requires special investigation.

It is worthy of note that the above results for 0-2 up to 0-8 are roughly given by the formula—

$$(467)...._0 p'_n = 1 - \frac{0.16}{n-1},$$

in which n is the total duration of marriage.

The figure (71) and table shew clearly that the maximum is a function of the duration of marriage as well as of age. To find the maximum value for any durations 0 to t the line of vertices C D on Fig. 71 must be followed, or during year-intervals t to t+1, the line C E must be followed. Thus for age 20 last birthday, the duration is 0 to 0.93, the probability is about 0.555. The graphic solution may also follow the method indicated in Fig. 71a, which needs no comment when examined in connection with Table LXXVI.

<sup>†</sup> These correspond to the values of the vertices on Fig. 71.

## Probabilities of a first-birth during first 6 years of marriage. Interval from marriage. 1.0 ਛ Fig. 71A. scale of Probability Ages of mothers at marriage. Fig. 71.

13. Determination of the co-ordinates of the vertices.—The representation of group-totals by means of integral functions of the values of the central abscissa of the group-base (central value of the interval) has been referred to in Part V., § 10, pp. 72, 73. In curves of the type which has just been considered, the results about the vertices may be closely represented by a curve of the second degree, and the curve itself may be regarded as defining the curve of group-totals for all values of the central abscissa (the abscissa of the middle ordinates of the group). In such instances the co-ordinates for the maximum-group may be very accurately ascertained from the tabular maximum together with the tabular values on either side of it. Let the maximum tabular value denote the point M on the curve, and the adjoining tabular values denote the points A, B, viz., the points on either side. Then, if the difference of the mean of the ordinates of the points A and B, and the ordinate of M be denoted by h, and the half difference of the ordinates of B and A be denoted by l, that is if-

$$(468)....h = y_m - \frac{1}{2}(y_b + y_a); \text{ and } l = \frac{1}{2}(y_b - y_a);$$
 then we shall have—
$$(469)....y_{max} = y_m + \frac{l^2}{4h}; x_{max} = x_m + \frac{l}{2h}$$

The proper maximum is greater than the tabular maximum by the amount  $l^2/4h$ , and its abscissa lies between that of the tabular maximum and the next highest tabular quantity distant from the former by the amount l/2h.

The positions of the vertices have been computed in this way. It remains to be noted, however, that when the value of the abscissa indicates merely the "age last birthday," it is necessary to add the amount ½ to the value given by the formula in order to refer the co-ordinates to the middle values of the group-abscissæ. Thus, in Fig. 71, the curves are plotted with the argument "age," i.e., last birthday, hence the vertex-value 20.74, see curve 0-1, and the maximum 0.5962, refer to the group of brides whose ages ranged between 20.74 years of age and 21.74 years of age. The middle value of the range is 21.24, but the average value is not that. The probability 0.5962 applies to the brides whose ages were between 20.74 and 21.74. Of 10,000 such, 5,962 would give birth to a first child within one year of marriage.

14. Average age of a group.—The error of adopting the middle value of any range has been considered in Part XII., § 20, pp. 200-201. It is sometimes preferable to relate the values of the dependent variable, not to the middle values but to the average values of the independent variable. In such a case formula (416), p. 201, may be used. Let A, M, and B be three group totals on equal bases k (equal intervals on the axis of abscissæ). The values of the co-efficients of a rational integral function of the second degree—the graph of which will represent, viz., the areas standing on the equal bases, the group-totals—may be found by the formulæ of Part V., §§ 1 to 9., pp. 64-72. The weighted mean abscissa of the middle group may be denoted by  $x'_m$ . If then we make the origin at 0, so that A is the integral of the equation  $a + bx + cx^2$  between the limits 0 and k, M the integral between k and 2k, and B between 2k and 3k, then we shall have—

$$(470)....x'_{m} = \frac{\frac{1}{12}bk^{2} + \frac{1}{4}ck^{3}}{a + \frac{3}{2}bk + \frac{7}{3}ck^{2}}$$

which may be put in the very simple form-

$$(471)....x_m + \epsilon = x_m + \frac{1}{24}k(B - A)/M.$$

This is the same formula as (416). In general, therefore, it is sufficient to find the value of the abscissa to which a group may be referred by using the value of the group and of these on either side: see the results as to average interval in §§ 21, 24, etc., hereinafter.

15. Curves of probability for different intervals derived by projection.—Reverting to Fig. 71, it may be noted that the probabilities of a first birth between 1 and 2 years, 2 and 3 years, etc., after marriage

may be derived for each age approximately by projection if the ratio of the aggregates and the position of the maximum are known. For example the faintly-dotted curve is the curve for the interval between 1 and 2 years after marriage derived by projection from that up to 1 year (0-1). The difference between the two curves is nearly negligible. The following are the relations between the curves :-

Let x, y be the co-ordinates of any point P on a curve, and let x', y'denote the co-ordinates of what may be called the corresponding point P', on a curve derived therefrom by drawing the line P P' Q to cut the axis (OX) of abscissæ in the point Q, so as to make the angle of intersection therewith, XQP, equal to  $\theta$ , and also the ratio QP'/QP equal to Then, if  $\theta$  and  $\rho$  be constant, the derived curve will belong to a family of curves of the type of the original, but differing therefrom in "skewness" if  $\theta$  be not 90°. The co-ordinates of any point P', viz., of the "corresponding point" on the derived curve are simply related to those of the point P on the original curve from which it was derived, being given by the equations-

$$(472)....y' = \rho y; \ x' = x - y(1 - \rho) \cot \theta.$$

Hence if the equation of the original curve be f(y) = F(x), that of the derived curve will be-

$$(473).....f\left(\frac{y'}{\rho}\right) = F(x'-ky');$$

in which  $k = \cot \theta (1 - \rho)/\rho$ .

To determine whether the succession of probabilities for 0-1, 0-2, 0-3, etc., and 0-1, 1-2, 2-3, etc., are rigorously derivable by projection would involve data embracing larger numbers and free from all uncertainty as to the effect of migration thereupon.

16. Numbers of first-births according to age and duration of marriage. —There were in Australia during the years 1907-14 inclusive, 220,021 cases of nuptial first births. The records of these were compiled according to "age last birthday," and duration of marriage." Multiplying the numbers as compiled by a factor, that would make the total 1,000,000, the results are as shewn in Table LXXVII., compiled for single months of duration of marriage from 1 to 12 months, and for single years of duration of from 1 to 26. The table thus furnishes the distribution of 1,000,000 nuptial first births according to age and duration of marriage. The figures for the months are of course only one-twelfth of the figures which would be comparable to the yearly values. This distribution may be called the nuptial protogenesic distribution.

TABLE LXXVII.—Shewing the Number in 1,000,000 Nuptial First-births of Births occurring for all Births occurring in Australia during the Years

AGR	: OE		_			1	NTERV.	AL AFTE	R MARI	RIAGE D	URING V	WHICH A	BIRTE	Occu	RS.					
More		0-1 mths.	1-2 mths.	2–3 mths.	3-4 mths.	4-5 mths.	5–6 mths.	6-7 mths.	7-8 mths.	8–9 mths.	9-10 mths.	10-11 mths.	11-12 mths.	0-1 year.	1-2 years.	2-3 years.	3-4 years.	4-5 years.	5-6 yrs.	6-7 yrs.
12 13 14		 0 32	 5 14	 0 23	 5 18	 0 9	0	 0 5	0	0	 0 5	 5 9	 0	 15 124	 4 0					
15 16 17 18 19	::	45 382 959 1,523 <b>1,886</b>	73 423 1,073 1,773 2,227	109 514 1,336 2,754 <b>3,513</b>	68 532 1,663 3,163 4,272	91 568 1,532 3,613 5,127	77 541 1,836 3,891 6,054	68 486 1,859 4,468 6,790	36 295 1,250 2,950 4,609	91 532 1,636 2,850	27 95 704 2,118 3,909	23 73 450 1,359 2,972	0 91 304 1,082 2,345	30,330	209 1,054 3,417	18 73 377 1,054	5 50	 9 0 32	  5 0	
20 21 22 23 24	::	1,754 1,877 1,532 1,113 986	2,236 <b>2,309</b> 1,827 1,523 1,104	3,172 3,454 2,682 1,941 1,586	4,104 <b>4,640</b> 3,445 2,909 <b>2,</b> 086	5,086 <b>5,704</b> 4,281 3,854 2,886	5,995 <b>6,981</b> 5,740 4,740 3,441	7,068 <b>8,331</b> 7,254 6,263 4,959	5,590 <b>6,613</b> 6,159 5,413 4,231	3,254 4,613 5,077 <b>5,177</b> 4,045	11,953	4,777 6,845 8,935 <b>9,226</b> 8,726	6,331	65,261 <b>65,621</b> 60,443	16,125	3,995	682 1,118 1,859	227 395 677	27 36 132 236 377	9 23 32 95 191
25 26 27 28 29		768 691 382 491 305	818 677 432 345 282	1,273 1,027 718 691 414	1,573 1,168 895 736 600	1,873 1,500 1,136 964 568	2,850 2,154 1,463 1,232 845	3,754 2,836 2,254 1,595 1,177	3,250 2,732 2,145 1,677 1,245	3,895 3,272 2,373 2,091 1,613	10,549 9,031 7,649 6,372 4,536	7,986 7,222 5,909 5,140 3,659	3,450	37,187 29,533	20,670 18,419 15,315	6,954 6,613 6,009 5,508 4,436	2,650 2,454	1,432	550 782 <b>800</b> 695 727	277 459 427 <b>541</b> 455
30 31 32 33	   	227 209 177 173 73	255 159 182 168 105	282 241 227 195 191	418 395 264 150 141	432 359 373 273 218	677 450 405 345 256	877 641 523 441 355	1,054 691 627 436 327	1,404 945 786 564 382	4,191 2,600 2,145 1,654 1,264	3,336 2,245 2,000 1,468 1,027	2,304 1,782 1,354 1,082 773	10,717 9,063 6,949	7,549 6,680 5,086	2,532 2,032	1,300 1,154	1,182 868 823 650 586	732 532 577 441 373	477 377 441 395 323
35 36 37 38 39		105 95 55 41 73	100 55 91 59 32	132 150 36 59 32	127 132 105 45 68	227 118 64 68 82	177 150 114 86 86	268 223 141 105 123	318 255 155 150 109	314 264 182 136 82	1,014 750 609 400 309	863 777 527 364 259		2,424	2,054	1,314 1,232 1,041 786 641	714 577 459 477 377	423 423 282 314 200	282 268 259 232 114	268 259 168 159 100
40 41 42 43 44		41 14 9 5 14	27 27 14 14 0	64 36 27 18 14	59 27 32 27 4	27 41 45 14 14	45 23 41 18 0	64 59 14 23 14	59 32 27 18 14	64 45 18 14 14	168 109 55 41 27	164 105 50 36	136 68 73 36 14	586 405 264	600 386 295	132	159 105	36	109 68 68 64 18	82 55 23 32 18
45 46 47 48 49	  	0 0 4	18 0 0 0 5	9 5 4 	0 0 5 0	9	•••	  	5		27 9 0 0 5	18 0 0 0 5	18 5 9 5 0	109 19 22 5 15	27 14 9		23	14 9 5 4	14 0 5 5 4	5 4 
50 51 52		::	-:- -:-							:: :::	0 0 4		.:	8 0 4				•••	.:	·· ··
dean I	imum nterval	20.0 0.0	20.1 0.1	20.1 0.2	21.0 0.3	20.2 0.4	20.6 0.5		21.2 0.6	22.4 0.7	22.4 0.8	23.0 0.9	22.80 1.0	•••	23.6 1.5	25.1 2.5	26.0 3.5	27.6 4.5	27.4 5.5	28.0 6.5
Max.†	iage		20.0 20.0 2,291 2,290	19.9 20.0 3,437 3,440	20.7 20.1 4,527 4,530	19.8 20.2 5,800 5,800	20.1 20.3 6,980 6,980	7,933	20.6 20.8 6,565 6,560	21.7 21.6 5,065 5,070		22.1 21.8 9,226 9,230	21.8 21.9 6,700 6,700	72,520	22.1 22.0 24,600 24,600		22.5 22.7 2,620 2,620	23.1 22.7 1,395 1,400	21.9 22.3 803 800	21.5 22.0 541 540
Fotals mooth				26,929			50,722		52,472							71,816	29,354	14,908	8,541	5,700
Ratio I		.1178	.1241	.1277	.1337	.1411	.1377	.1258	.1250	.1108	.1089	.1066	.1084		.0993	.0969	.0893	.0939	.0936	.0947

<sup>\*</sup> Age at beginning of year of maximum. Add 0.5 year for the median age of the

durations of Marriage up to 26 Years with Women of Ages 13 to 52 inclusive. Based upon 220,021 1907-1914 inclusive. Unadjusted Numbers.

		INTERVAL AFTER MARRIAGE DURING WHICH A BIRTH OCCURS.  8-9   9-10   10-11   11-12   12-13   13-14   14-15   15-16   16-17   17-18   18-19   19-20   20-21   21-22   22-23   23-24										н Осс	URS.				TOTAL N	UMBER OF Births.	AGE OF		
7-8 yrs.	8-9 yrs.	9–10 yrs.	10-11 yrs.	11–12 yrs.	12-13 yrs.	13–14 yrs.	14–15 yrs.	15–16 yrs.	16-17 yrs.	17-18 yrs.	18–19 yrs.	19–20 yrs.	20–21 yrs.	21–22 yrs.	22-23 yrs.	23–24 yrs.	24–25 yrs.	25-26 yrs.	1-26 years.	0-26 years.	MOTHERS.
 ::	::	::				::		.:										::	4		
		•••	••		•••							 						:: :::	18 236 1,141 3,849 9,035	4,327 14,639 34,179	16 17 18
0 14 9 36 82	is	: :: :i8	  9		•••								::	  				::	14,371 20,057 27,906 32,918 <b>34,582</b>	66,879 85,318 <b>93,527</b> 93,361 86,412	20 21 22 23 24
136 200 232 345 305	118 145 200	14 55 77 127 127	18 18 64 36 82	14 18 5 27 23	0 5 14 18 41	4 0 0 5 9				•••		::	::	:	•••				33,600 32,688 30,215 26,703 22,222	59,748 51,487	27
391 327 300 323 250	191	227 177 191 177 136	114 118 <b>205</b> 123 145	86 45 100 77 132	55 32 91 <b>109</b> 100	14 41 27 68 82	9 41 36 27	9 4 5 9 23	0 0 4 9 5	0 0 14 5 9	4 0 0 0 5	 4 0 5	::	:. :: ::	::			::	19,975 14,860 13,526 10,885 8,836	17,834	33
232 195 136 123 77	177 164 86 132 59	150 95 86 123 64	105 145 77 50 64	73 100 77 82 59	105 50 77 73 91	114 45 59 18 45	41 32 41 32 27	36 <b>68</b> 41 36 23	23 18 36 <b>45</b> 9	9 14 32 <b>64</b> 18	14 9 9 <b>27</b> 23	0 14 9 9 5	4 0 5 18 14	  5 9	   4		   5		7,614 6,362 5,034 4,595 3,455	11,818 9,781 7,458 6,440 4,942	35 36 37 38 39
14 36 36 32 18	23	32 41 36 14 19	32 27 27 5 9	32 23 9 9 5	27 18 14 0 0	59 9 9 9	14 0 5 0 18	23 14 9 18 14	27 23 9 5 9	18 18 18 9 0	14 23 5 4	14 9 <b>27</b> 5 0	9 5 4 0 0	14 14 0 0 9	4 5 5 5 0	9 0 5 5 0	0 4 0 0 0	  	2,710 1,601 1,285 802 537	3,628 2,187 1,690 1,066 675	40 41 42 43
5 9 5 0 4		  	0 0 0 4	5 0 • 4 ·		9 5  		•••		0 4 	::	0 4 		0 5  	14 0 	 	••	0 0 5 	281 117 74 27 18	390 136 96 32 33	45 46 47 48 49
_:: :-	::	::		::		:: _::	::	:: -:	:: ::	::	::				•••	::	::	::		17 4 4	50 51 52
30 7.5	30 8,5	31 9.5	$^{32}_{10.5}$	34 11.5	33 12.5	35 13,5	35 14.5	36 15.5	38 16.5	38 17.5	38 18.5	40 19.5	39 20.5	$\frac{41}{21.5}$	45 22.5	?	?	?	::	::	*Age at Maximum MeanInt'rv'l Age at
22.5 22.0 391 390	21.5 21.9 264 285	21.5 $21.8$ $227$ $225$	21.5 21.7 205 175	22.5 $21.6$ $132$ $140$	20.5 21.5 109 115	21.5 21.4 114 93	20.5 21.3 41 75	20.5 21.2 68 60	21.5 21.1 45 47	20.5 21.0 64 36	19.5 20.9 27 27	20.5 20.8 14 20	18.5 20.7 14 15	19.5 20.6 14 11	22.5 20.5 14 8	20.4 9 6	20.3 5	20.2 9			Marriage do., sm'thed Frequencyat Max†(crude) do.,(sm'thed
3,872	2,691		1,486	1,005	920 820	631 620	332 442	332 322	221 264	232 193	137 140	105 101	59 72	56 51	41 37	23 25	9 16	14 9	392,152 1,000,000		
.101	.106	.112	.117	.139	.140	.150	.170	.186	.178	.187	.193	.198	.208	.216	.216	.240	.313	.444	••	••	Ratio Max. to Totals

maximum 12 months. 

† The frequency at the maximum is for the age.

The detailed results for the successive years shew considerable regularity in the frequency of first births even for individual ages, as for example the births, for ages 23 and 25 during the tenth month and first year after marriage, were respectively as follows:—

Interval.	Year.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1908–1914
Months	Number (23)	239	232	261	302	328	314	354	290.0*
10-11	Number (25)	195	184	237	249	288	296	308	251.0*
	Corresponding Marriages	32,480	32,704	34,127	36,953	39,815	42,078	41,808	37,138*
V	Number (23)	622	685	688	698	860	888	909	764.3*
Years 1–2	Number (25)	559	631	604	654	757	813	820	691.1*
	Corresponding Marriages	31,440	32,510	33,163	35,183	38,037	40,814	41,870	36,145*

\* Average for the period 1908-1914.

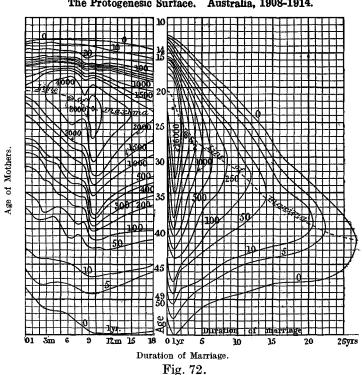
The significance of these figures, which are taken at random, is seen, when the "corresponding marriages" (i.e., the marriages earlier, by the proper interval, than the year indicated) are taken into account. The interval in question is about  $10\frac{1}{2}$  months in the one case, and 18 months in the other. Thus for the two upper numbers the figures adopted for 1908 are those for 1907, plus one-eighth of the difference between them and those for 1908, and so on; and for the lower numbers the mean of the figures for 1906 and 1907; and similarly throughout. The ratio of each number to the seventh of the total shews the degree of correspondence since the whole of these ratios are relative, and the vertical columns should be identical for exact correspondence. The ratios corresponding to the six lines above are:—

Interval.	Year.	1908.	1909.	1910.	1911.	1912.	1913.	1914.
M. 11.	Number (23)	.82	.80	.90	1.04	1.13	1.08	1.22
Months 10-11	Number (25)	.78	.73	.94	.99	1.15	1.18	1.23
•	Corresponding Marriages	.87	.88	.92	.99	1.07	1.13	1.13
37	Number (23)	.81	.89	.90	.91	1.13	1.16	1.19
Years 1-2	Number (25)	.81	.91	.87	.95	1.09	1.18	1.19
	Corresponding Marriages	.87	.90	.92	.97	1.05	1.13	1.16

Seeing that the original numbers are very limited, the agreement is remarkably good, and confirms the utility of Table LXXVII., and the utility of the graphs of the protogenesic surface, to which surface reference will now be made.

The nuptial protogenesic boundary and agenesic surface.—If the relative numbers of first-births, after different durations of marriage and for different ages of women, given on Table LXXVII., are regarded as vertical (z) ordinates, with the ages of women and duration of marriage as the other two ordinates (x and y), the surface so defined may be called the nuptial protogenesic surface or surface of nuptial primiparity. In the graph of such a surface the area for which the ordinates are zero may be called the agenesic region, or the surface of absolute sterility; and the boundary between the two may be called the agenesic boundary.

The values of x and y for all points on the boundary between the agenesic region and the protogenesic surface are the ages and corresponding durations of marriage which define the existence of perfect sterility. Thus with a duration of marriage of say  $6\frac{1}{2}$  years there were no cases of first-births among women of  $19\frac{1}{2}$  years of age in the records extending from 1908 to 1914; see Table LXXVII. or Fig. 72.



The Protogenesic Surface. Australia, 1908-1914.

The contours represent equal frequency of first-births with varying age and duration of marriage. The area outside the contour 0 is the agenesic region. The figures on the contours are per million first births, for all women of age x last birthday, and for durations of marriage t to t+1, where t is expressed in months on the left hand part of the figure and in years on the right hand part.

The characteristic features of the protogenesic surface are shewn in Figs. 72 and 73. On Fig. 72 this surface is defined, by contours, on extended lateral scale for 0 to 18 months after marriage, and on a smaller lateral scale from 0 to 27 years after marriage, and in both cases for the whole nuptial reproductive period, say 13 to 52 first-births. A vertical frequency of 1 on the right hand side of Fig. 72 corresponds to the

## Profiles of the Protogenesic Surface.

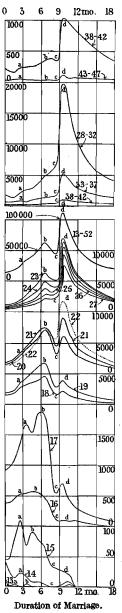


Fig. 73.

frequency of 12 on the left hand side. The line of maxima is shewn by a broken line on the figure. In Fig. 73 the vertical sections of the protogenesic surface are shewn for each age from 13 to 27 years ("age last birthday"), and for the 5-year groups 28-32, 33-37, 38-42, 43-47, and for the group for all ages from 13 to 52.

The frequencies of first-births, which are identical on any contour, are indicated by figures. These are per million total first births for intervals of a month of duration of marriage on the left-hand side of the figure, and for intervals of a year's duration of marriage on the right hand side. The "age" indicated is always to be taken as the "age last birthday," or what is the same thing, and more general, for the age x to the age x+1.

It will be seen that these contours constitute a family of curves for which there is no simple mathematical specification. The unique maximum shewn by a small contour like an "O" on the left hand side of the figure and by an asterisk on the right hand side.

The profiles of the protogenesic surface, shewn on Fig. 73, from 0 to 18 months, are the curves shewing the frequency at various ages, for a total of a million first-births at all ages, and for the first 18 months after marriage. These curves have characteristic similarities, indicated by the points letters a, b, c, d, on the figure. The similarities are important since they shew that there is a remarkable regularity in the interval between marriage and first-birth in women of different ages. The curves drawn are not for instantaneous group-values, viz., for the groups x to x+dx, but are the values for mensual groups, the abscissæ for which are referred to the middle of the month.

## 18. Curve of nuptial protogenesic maxima.

—The curved broken line on Fig. 72, shewing the ordinates for greatest frequency of first-birth, can be replaced by a regular curve, which will give the actual values of these ordinates with sufficient precision. Adopting as the argument the "age last

birthday," that is the initial value of the age where the range is from x to x+1, and for the corresponding initial value of the duration y, where the duration meant is from y to y+1, we have—

$$(474)...y = 1.45 \ \xi^{\frac{5}{3}} = 1.45 \ (x - 20)^{\frac{5}{3}}$$

 $\xi$  being the "age last birthday" less 20. This gives the values on the upper line, while those on the lower are scaled from Fig. 72:—

Age	20	25	30	35	40	
Calc. Value	0.0	2.12	6.73	13.23	21.37	(Initial value of the duration.)
Graph Value	0.0	2.2	7.0	13.0	21.5	( ,, ,, ,,

The maximum frequency per million total births, where the age is "age last birthday," and the duration is from y to y+1, cannot be expressed by any simple mathematical formula. The values, however, are given at the bottom of Table LXXVII.

- 19. **Ex-nuptial protogenesis.**—The previous issue is not ascertained in the case of ex-nuptial births, and the point of time to which the interval corresponding to duration of marriage should be referred cannot be defined. Hence no comparison can be made with nuptial protogenesis.
- 20. Average age for quinquennial age-groups of primiparæ.—The following table gives the average age of mothers of first-births in quinquennial groups:—

TABLE LXXVIII.—Average Age of Mothers, First-births, for Quinquennial Groups.

***************************************										
Age-group	 14	15–19	19	20-24	25-29	30-34	<b>35</b> –39	40-44	4549	50-52
Average Age	 14,36	18.78	18.77	22.61	27.19	32.06	37.08	41.74	46.31	41.84
Middle Age	14.0	17.50	16.51	22.50	27.50	32,50	37.50	42.50	47.50	46.50
Difference	 +0.36	+1.28	+2.27	+0.11	-0.31	-0.44	-0.42	-0.76	-1.19	-4.66
		ì	I		1			1		

The differences between the middle and average ages are obviously too large to be neglected, and therefore it is always necessary to decide whether the average value or the middle value of the ranges of the argument (age-group ranges) shall be used. In general the middle value is the more convenient.

21. Average interval between marriage and a first-birth, a function of age.—The data furnished in Table LXXVII. show that the average interval between marriage and first-births is a definite function of age. <sup>1</sup>

¹ T. A. Coghlan, in his "Child-birth in New South Wales, a study in statistics," has given results (see his Table VIII., on p. 26) for the average period from "marriage to birth of first-child" for "post-nuptial conceptions only." He introduces an adjustment for the non-stationary character of the population from which they are derived, see p. 26. His main result, however, is wholly erroneous, and the true result is inconsistent with his conclusion, viz., that for married women between the ages of 17 and 39 the average period between marriage and a first-birth is only 19.4 months, and the range between 18.3 and 21.5 months. The matter will be referred to more fully later, see pp. 271-2, and particularly the note on the latter page.

If age-groups of primiparæ be formed, it is found that the mean ages of the groups and the average intervals between marriage and first-births are as shewn in the third column of the Table hereunder, viz., LXXIX., see also Figs. 74 and 75. The average values of the ages and of the corresponding intervals are as follows:—

TABLE LXXIX.—Average Ages and Average Interval between Marriage and First-births.

(i.) A	ge of	Married	Women		Under 20	20-24	25-29	30-34	3539	40-44	45-49
(iii.) A	verage verage	interval	between		18.77	22.61	27.19	32.06	37.08	41.74	46.31
	(crude	e and Fir data) interval			0.623	0.994	1.483	2.026	2.862	3,501	4.048
	mula		othed dat	a)	0.604	0.991	1.502	2,100	2.766	3.420	4.209
(v.) I	) <b>iffer</b> er	ice (data-	-calc.)	• •	+0.019	+0.003	0.019	0.074	+0.096	+0.080	0.161

The values on line (iii.) are fairly well given by the simple formula :—  $(475).....i = 0.0437 \chi + 0.01221 \chi^{1.5}$ 

where i is the average interval between marriage and the first-births, and  $\chi$  is 11 years less than the average age, a 5-year group, that is to say, the age 11 is taken as the zero of  $\chi$ . This age has not been arbitarily adopted, but, as is shewn by the line OP on Fig. 74, is indicated as the minimum • age to which reproductive facts should be referred. (See Table LXXII., p. 239 and p. 268).

The small crosses in Fig. 75 are the results for individual years of age last birthday, computed by means of the formula (475); see p. 268.

There is a fairly definite indication that the continuation of the curve should be as shewn by the broken line in Figs. 74 and 75, terminating therefore at about age 55. There are, however, so few births at ages greater than 45, that this part of the curve cannot be regarded as yet well determined or determinable: see p. 268.

The following Table, LXXX., gives the results in greater detail, and furnishes also smoothed values of the approximate average interval between marriage and first-births for all first-births within a year of marriage, and for all ages during the reproductive period. Since formula (475) refers to the average age, it will not give the quantities in the Table LXXX:—

¹ The intervals are only approximate. They have been calculated by assuming that the births in each month during the first 12 months may be referred to the middle of the months, and those during the intervals of from 1-2 years onwards may be referred to the middle of the year. The change in rapidity of births is so great during the year after that of marriage that a correction is necessary for rigorous accuracy. That the difference is appreciable is obvious from the following results:—

	lst Births	lst Births	All First-
	to 9 mths	to 12 mths	births.
Approximate average interval, age 22 Average interval more rigorously calculated	5.52	7.53	11.70 months
	5,53	7.54	10.88 months

The intervals are found more rigorously hereinafter for births occurring not earlier than nine months after marriage.

TABLE LXXX.—The Protogenesic Indices, according to Age. (Approximate Average Intervals between Marriage and First-births)\* Australia, 1908-1914.

					AVER	AGE INTI	RVAL.			
Age Mot		within 1	Occurring 2 months fter riage.	Births Occurring after 12 mths. Marriage.			All First	-births.	r · ·	
		Crude Result.	Smo'th'd Result.	Crude Result.	Crude Result.	Smo Res	othed ult.	Smoo Res		Interva for Age Group. Crude Result.
Yea	rs.	Months.	Months.	Months.	Months.	Mon	ths.	Ye	ars.	Months.
10 11 12 13 14	•••	5.17 3.39	2.88 3.49	18,00	8.38? 3.39	0. 1. 2.	00 85 72 61 53	0. 0. 0.	00 071 143 217 294	4.03
15 16 17 18 19		4.41 4.49 5.12 5.64 6.07	4.06 4.60 5.11 5.58 6.03	18.00 19.85 19.15 19.54 19.94	4.80 5.33 6.21 7.20 8.32	5. 6. 7.	47 44 44 47 53	0. 0. 0.	373 453 537 623 711	(7.48) 7.55
20 21 22 23 24	•••	6.56 6.89 7.53 7.77 8.04	6.44 6.82 7.11 7.48 7.77	20.57 $21.19$ $21.51$ $22.84$ $23.99$	$\begin{array}{c} 9.57 \\ 10.25 \\ 11.70 \\ 13.08 \\ 14.42 \end{array}$	9. 10. 11. 13. 14.	91 10	0. 0. 1.	802 896 992 092 195	11.93
25 26 27 28 29		8.26 8.36 8.55 8.52 8.61	8.02 8.24 8.43 8.58 8.71	25.29 26.69 27.75 29.46 30.95	15.61 16.94 18.20 19.38 20.94	15. 16. 18. 19. 21.	91 26 65	1. 1. 1.	300 409 522 638 757	17.80
30 31 32 33 34	•••	8.75 8.64 8.55 8.49 8.46	8.80 8.86 8.89 8.88 8.85	33.68 34.39 37.44 39.41 42.38	22.81 23.60 25.85 27.36 29.96	22. 24. 25. 27. 28.	08 65 26	1. 2. 2. 2. 2.	880 007 137 272 411	25.15
35 36 37 38 39		8.30 8.30 8.44 8.45 7.99	8.78 8.68 8.55 8.38 8.19	43.75 45.85 47.51 52.24 50.15	31.14 32.73 34.82 39.70 37.47	30. 32. 34. 36. 38.	64 41 22 09	2. 2. 2. 3.	553 700 852 008 168	34.34
40 41 42 43 44		7.71 7.62 7.32 7.26 6.87	7.96 7.70 7.41 7.08 6.73	49.74 55.74 56.15 53.32 59.80	39.09 42.82 44.50 41.90 48.99	40. 42. 44. 46. 48.	03 13 28	3. 3. 3.	333 503 677 856 041	42.01
45 46 47 48 49		7.46 8.25 5.90 11.50 7.17	6.34 5.92 5.47 4.98 4.47	55.77 78.92 64.50 52.00 54.00	42.13 69.50 50.55 46.21 33.93	50. 53.11† 55.51 57.98 60.52	77 51.50‡ 50.55 46.22 40.50	4.426† 4.626 4.832 5.043	231 4.292‡ 4.212 3.851 3.375	48.58
50 51 52 53 54	::	7.50 9.50	3.92 3.34 2.73	66.00 18.00	36.75 18.00 9.50	63.12 65.79 68.53 71.34 74.23	30.50 18.00 9.50 3.00 1.20	5.260 5.483 5.711 5.945 6.185	2.542 1.500 0.792 0.250 0.100	28,54
55			••	٠		77.18	0.00	6.432	0.000	
			months years	29.06 m. 27.34 yrs.			15.95 r 25.43	nonths. years.		

<sup>\*</sup> Based on a total of 220,021 births. † These values from ages 46 to 55 are merely extensions of the curve. † These values are probably fairly reliable.

The yearly groups may with advantage be referred to the "age last birthday," instead of the middle-age value, which is approximately the "age last birthday plus  $\frac{1}{2}$ ." Let then  $\xi$  denote the "age last birthday," less 10; the intervals are found to be very accurately given in months and in years respectively by the following formulæ, viz.:—

$$(476)...i' = 0.8364\xi + 0.01062\xi^2 + 0.000198\xi^3$$
, and for months;<sup>1</sup>

$$(476a)...i'' = 0.0697\xi + 0.000885\xi^2 + 0.0000165\xi^3$$
, for years:

 $\xi$  is of course expressed in years in either case. The values may be readily computed by taking the interval for age 10 as zero, and the smoothed results for 20, 30 and 40, and applying formulæ (199) to (199c), see Part V., § 7, p. 69, and remembering that the coefficients b, c, d vary inversely as the variable, and as the square, and the cube of the variable, respectively. To develope the table we may calculate the values for 11, 12 and 13 (i.e., for  $\xi = 1$ , 2 and 3), or calling the leading differences for 10 years as  $D_1$ ,  $D_2$ , and  $D_3$ , the leading differences  $d_1$ ,  $d_2$  and  $d_3$  can be found by the formulæ<sup>2</sup>—

$$(477)....d_1 = 0.1D_1 - 0.045D_2 + 0.0285D_3$$

$$(477a) \ldots d_2 = \ldots \qquad 0.01D_2 - 0.009D_3$$

$$(477b) \dots d_3 = \dots \qquad 0.001D_3$$

We have also, for the coefficients of the equations above :-

$$(478)....b = d_1 - \frac{1}{2}d_2 + \frac{1}{3}d_3$$

$$(478a) \ldots c = \ldots \frac{1}{2} d_2 - \frac{1}{2} d_3$$

$$(478b) \ldots d = \ldots \qquad \frac{1}{4}d_3$$

The agreement between the crude values and the values by formula (476) for the average interval between marriage and first-birth is remarkably close throughout, the curve applying as far as age 45. Beyond this age the values for the extrapolated curve are given as well as those of the probable value of the interval.

22. The protogenesic indices.—The average interval, calculated as shewn in the preceding section (viz., by formula (484) in the section next following, § 23, but omitting the correction term  $\epsilon$ ) is not rigorously

<sup>1</sup> These formulæ are for the "approximate" average interval; see the preceding note.

<sup>&</sup>lt;sup>2</sup> See Text Book, Institute of Actuaries, Part II., Chap. XXIII., Art. 22, p. 443, Edit. 1902.

exact, but is sufficiently approximate to be used as an index of the frequency distribution throughout the interval. We shall call the interval so calculated the protogenesic index for married women of the age in question, and for all ages, the general protogenesic index.1

Table LXXX. is thus a table of protogenesic indexes rather than a table of average intervals, though the intervals are approximately correct.

We shall now consider methods of correctly estimating the interval.

Exact evaluation of the average interval from a limited series of group-values.—The average interval may be determined with a higher degree of approximation from the series of group-values for equal ranges themselves by formulæ developed as follows:—Since the group-values can often<sup>2</sup> be reproduced with sufficient accuracy by a rational integral function we have, in such cases, for the value  $(x_m)$  of the interval (the distance to the centroid vertical) :-

$$x_m = \frac{\int_{\circ}^{x} \frac{dx}{dx}}{\int_{\circ}^{x} \frac{dx}{dx}} \equiv \frac{\frac{1}{2}ax^2 + \frac{1}{3}bx^3 + \text{etc.}}{ax + \frac{1}{2}bx^2 + \text{etc.}} = \frac{1}{2}x + \frac{bx^2 + cx^3 + \frac{9}{10}dx^4 + \frac{4}{5}ex^5 + \dots}{12a + 6bx + 4cx^2 + 3dx^3 + \frac{12}{5}ex^4 + \dots}$$

in which last expression we may substitute, by means of formulæ (195) to (197), see Part V., § 5, pp. 67, 68, the values of the groups themselves for a, b, c, etc. This will give a series of formulæ according to the number of groups taken simultaneously into account. We may take the common value and the ranges as unity: if it be k the value deduced will then be multiplied finally by k.

It will be convenient to call the group values A, B, C, etc., hence if n of these are included, n will be the value of x. That is to say, in formulæ in which D appears, x will be 4. From (479) we thus obtain the following series of formulæ, viz :-

$$(480).....x_{m} = 1 + \frac{2}{3} \cdot \frac{-A + B}{A + B}; \text{ for } x = 2;$$

$$(481).....x_{m} = 1\frac{1}{2} + \frac{9}{8} \cdot \frac{-A + C}{A + B + C}; \text{ for } x = 3;$$

$$(482).....x_{m} = 2 + \frac{4}{45} \cdot \frac{-19A - 3B + 3C + 19D}{A + B + C + D};$$

$$\text{for } x = 4; \text{ and}$$

$$(483).....x_{m} = 2\frac{1}{2} + \frac{125}{288} \cdot \frac{-5A - 2B + 2D + 5E}{A + B + C + D + E}; \text{ for } x = 5$$

<sup>1</sup> To fully define the term it should be preceded by the term "nuptial"; but for obvious reasons this may be always understood.

<sup>&</sup>lt;sup>2</sup> But not invariably: see latter part of Section 24.

If the common range be k, these expressions should of course be multiplied by that quantity.

From these formulæ multiply-infinite series of formulæ may be developed, and such development can be effected by processes similar to those indicated in Part VI., § 2, and Table VI., pp. 75 to 77.

A practical way of applying the formulæ is to calculate by an approximate method and make the necessary correction, if it be sensible. Thus:—

(484).....
$$x_m = \frac{(A+3B+5C+7D+\text{etc.})}{2(A+B+C+D+\text{etc.})} + \epsilon$$

where  $\epsilon$  is a small quantity. For the value of  $\epsilon$ , we have, from (480) to (483):—

(485)...
$$\epsilon_2 = \frac{1}{6} \cdot \frac{-A+B}{A+B}$$
; when there are two quantities only.

(486)... 
$$\epsilon_3 = \frac{1}{8} \cdot \frac{A+C}{A+B+C}$$
; when there are three quantities only.

$$(487)..\epsilon_4 = \frac{1}{90} \cdot \frac{-17\,A \,+\, 21\,B - 21\,C \,+\, 17\,D}{A \,+\, B \,+\, C \,+\, D}\,; \text{ when}$$

there are four quantities only.

$$(488)..\epsilon_5 = \frac{1}{288}.\frac{-49\ A + 38B - 38D + 49E}{A + B + C + D + E}: \text{ when there}$$
 are five quantities only.

 $\Sigma_n$  denoting the sum of *n* successive groups, *A*, *B*, etc., these expressions may be put in the arithmetically more convenient form hereunder, viz.:—

$$(489)....\epsilon_{2} = 0.1\dot{6}(B - A) / \Sigma_{2}; \ \epsilon_{3} = 0.125(C - A) / \Sigma_{3};$$

$$\epsilon_{4} = \{ 0.1\dot{8}(D - A) - 0.2\dot{3}(C - B) \} / \Sigma_{4}$$

$$(490)...a_{5} = \{0.17014(E-A) - 0.13194(D-B)\}/\Sigma_{5}$$

Whenever each group-value in a series is not greater than say 2 to  $2\frac{1}{2}$  times an adjoining group-value, the preceding formulæ give fairly good results, and may be used for a succession of three, four, or five groups in a way which will now be indicated.

24. Evaluation of group-intervals for an extended number of groups.— To apply the preceding formulæ to a large number of groups it will be convenient to adopt the following notation. Let A, B, C, etc., be denoted by  $A_1$ ,  $A_2$ ,  $A_3$ , etc., and let also  $x' = x_m$  for  $A_1$  to  $A_k$  reckoned from the beginning of  $A_1$ ,  $x'' = x_m$  for say  $A_{k+1}$  to  $A_m$ , etc., reckoned

not from the beginning of  $A_{k+1}$ , but from the beginning of  $A_1$ ; and so on. Let also A', A'', etc., denote the totals of the various series of groups in question; that is, let  $A^{\,\prime}=A_1+\,A_2\,+\,{
m etc.}\,;\;\;A^{\,\prime\,\prime}\,=\,A_{k+1}$ +  $A_{k+2}$  + etc.; and so on. Then the value for the entire series is :-

$$(491)...._{0}x_{m} = \frac{A'x' + A''x'' + A''' x''' + \text{etc.}}{A' + A'' + A''' + \text{etc.}} = \frac{\Sigma(A'x')}{\Sigma A'}$$

Consequently, if  $x' = w' + \epsilon'$ , where w' is an approximate value of x' and  $\epsilon'$  is the correction to make it exact, we shall have for the true value of  $_{0}x_{m}:-$ 

$$(492).... _{0}x_{m} = \frac{\Sigma(A'w')}{\Sigma A'} + \frac{\Sigma(A'\epsilon')}{\Sigma A'}$$

in which  $\Sigma(A'\epsilon')=A'\epsilon'+A''\epsilon''+$  etc. Let the factors 1/6, 1/8, 1007/90, 3051/90, 49/288, 38/288, on formulæ (485) to (488) be denoted by  $a_1$ ,  $a_2$ , etc., and generically by a', a'', etc. Then, since when  $\epsilon'$ ,  $\epsilon''$ , etc., are multiplied respectively by A', A'', etc., their denominators disappear, we have, for the total correction  $\epsilon_0$  say, the sum of the numerators divided by the sum of all the groups.  $\alpha A'$ ,  $\alpha'' A''$ , etc., denoting the numerators, we have :-

$$(493)...._0 x_m = \frac{\Sigma(A'w')}{\Sigma A'} + \frac{\Sigma(\alpha' A')}{\Sigma A'}$$

that is to say, the approximate value of the average interval, found by multiplying each group by the middle value of its interval, and dividing the sum of all the products by the sum of all the groups, merely requires the correction found by multiplying each group by its correction coefficient (a), and dividing by the sum of the whole of the groups. formulæ may be developed to embrace the corrections by multiplying the individual groups by factors, and these factors are readily found by summations. Thus we obtain the following, viz.:—

$$\begin{array}{c} (494) \ldots_{\bf 0} x_{\bf m} = (0.375\,A_1 + 1.5\,A_2 + 2.625\,A_3 + 3.375\,A_4 + 4.5\,A_5 \\ + 6.625\,A_6 \,\, + {\rm etc.}) \,/\,\varSigma\,A. \end{array}$$

the series of coefficients being in threes; thus the coefficient for the third term from any term of the series is 3 greater than that of the term from which it is reckoned. Further, :-

$$(495).._0 x_m = (0.3\dot{1} A_1 + 1.7\dot{3} A_2 + 2.2\dot{6} A_3 + 3.6\dot{8} A_4 + \text{etc.}) / \Sigma A; \text{ and}$$

$$\begin{array}{l} (495) \ldots_0 x_m = & (0.3\dot{1}\ A_1 + 1.7\dot{3}\ A_2 + 2.2\dot{6}\ A_3 + 3.6\dot{8}\ A_4 + {\rm etc.}) \\ /\ \mathcal{L}\ A\ ; \ {\rm and} \\ (495a) \ldots_0 x_m = & (0.32986\ A_1 + 1.63194\ A_2 + 2.5\ A_3 + 3.36806\ A_4 \\ +\ 4.57014\ A_5\ +\ {\rm etc.})\ /\ \mathcal{L}\ A\ ; \end{array}$$

the series of coefficients being respectively in fours and in fives: thus the coefficient of the fourth term in the one case, and of the fifth term in the other, from any term in the series, is 4 greater in the former case and 5 greater in the latter, than the coefficient of the term from which it is reckoned.

<sup>1</sup> It is of course immaterial what number of groups are combined.

25. Average interval for curves of the exponential type.—In cases where  $A_2$  is very small (or very large) compared with  $A_1$ , the preceding formulæ are not very accurate. In general, if the curve giving the groups be approximately of the type  $e^{\pm mx}$ , and the groups be also very different in magnitude, it is preferable to proceed as follows:—2

Let  $A_1$ ,  $A_2$  be two adjoining groups; these can be satisfied by the equation:—

$$(496)...y = Be^{bx}, \text{ or } y = e^{a+bx};$$

in the former of which, therefore,  $B=e^a$ . Similarly three adjoining groups,  $A_1$ ,  $A_2$  and  $A_3$  may be satisfied by the equation:—

$$(497)\ldots y = A + Be^{bx}$$

Putting  $A_1$  the group for the range 0 to 1;  $A_2$  the group with the range 1 to 2;  $A_3$  the group with the range 2 to 3; we have from these equations the following, viz.:—From (496):—

(498)..... 
$$\frac{A_2}{A_1} = \frac{A_3}{A_2} = e^b$$
; or  $b = 2.3025851 \log_{10} \frac{A_2}{A_1}$ 

and this applies to a whole series of groups if the ratio  $A_{n+1}/A_n$  be constant. Also :—

$$(499)....B = \frac{b A_1}{e^b - 1} = \frac{b A_2}{(e^b - 1)e^b} = \frac{b A_3}{(e^b - 1) e^{2b}} = \text{etc.}$$

the final equation in (499) being true only if  $A_3/A_2 = A_2/A_1 = n$ , say.

From (497) we have, similarly to (499):—

(500)... 
$$A_1 = A + B(e^b - 1)/b$$
;  $A_2 = A + B(e^b - 1)e^b/b$ ; 
$$A_3 = A + B(e^b - 1)e^{2b}/b$$
;

and consequently:-

(501)....
$$(A_3 - A_2) / (A_2 - A_1) = e^b$$
,  
or  $b = 2.3025851 \log_{10} \{ (A_3 - A_2) / (A_2 - A_1) \}$ ; etc.

<sup>&</sup>lt;sup>1</sup> For example, if there be two groups, on equal bases  $0 \cdot x$ ,  $x \cdot 2x$ , one of which is three times greater than the other, the straight line (which in such a case would be the assumed curve, giving areas equal to the groups), would start at the terminal 0 (or 2x) of one of the groups. If one is greater than 3 times the other, it will fall within one of the rectangles. The question has been exhaustively considered by Prof. Karl Pearson, see Biometrika, Vo. I., pp. 265-303, Vol. II., pp. 1-23.

 $<sup>^2</sup>$  As the formulæ of this section are of general application x has been used for the independent, and y for the dependent variable.

Writing n for  $e^b$ , we have also :—

(502)..
$$B = b (A_2 - A_1)/(n-1)^2 = b (A_3 - 2A_2 + A_1)/(n-1)^3$$
, etc.;

and

$$(503)$$
.....  $A = A_1 - \frac{B}{b}(n-1) = A_1 - \frac{A_2 - A_1}{n-1} = \frac{A_1n - A_2}{n-1}$ , etc.

Thus the constants b, B and A in (497) are determined.

In applying these formulæ to ascertain the average interval, four cases will require specially to be considered, viz., when the factor b is positive, and when it is negative, the range being either 0 to 1, or 1 to 2 in both cases. For the ascending and descending branches respectively, these cases correspond to the curves  $Be^{bx}$  and  $Be^{-bx}$ . For the purpose in view (496) is suitable, and the results, to be tabulated for various ratios of  $A_1/A_2$  or  $A_2/A_1$ , will be the groups  $B\int_0^1 e^{bx}$ ,  $B\int_1^2 e^{bx}$ ,  $B\int_0^1 e^{-bx}$ , and  $B\int_1^2 e^{-bx}$ . The mean interval lies between the centre of the grouprange and the side on which the groups have higher values. For the more general case, that is when three values are satisfied, we should have to determine

$$(504)..x_{m} = \frac{\int xydx}{\int ydx} = \frac{\int x(A + Be^{bx})dx}{\int (A + Be^{bx})dx} = \frac{\frac{1}{2}Ax^{2} + B\{(bx - 1)e^{bx} + 1\}/b^{2}}{Ax + B(e^{bx} - 1)/b}$$

If A, however, be taken as zero, this last will become

$$(505)...._0 x_m \equiv \frac{(bx-1)e^{bx}+1}{b(e^{bx}-1)} = \frac{xe^{bx}}{e^{bx}-1} - \frac{1}{b}$$

which function is the basis of the tabulation hereunder for ratios of  $A_2$  to  $A_1$  and for ranges of x=1 and 2, by applying (498). It may be noted that the value of (505) = 0 for x=0. In the table hereunder, LXXXI., the four cases above referred to are as follows:—

These four cases are illustrated by Fig. 78, hereinafter.

The necessary formulæ for calculating the required values are simple if we put  $A_2 = n A_1$ , viz.:—

$$(506) \dots {_{0}}x'_{1} = 1 + \frac{1}{n-1} - \frac{1}{b}; \ {_{1}}x'_{2} = 2 + \frac{1}{n-1} - \frac{1}{b}; \ \dots_{p-1}x'_{p} = p + \frac{1}{n-1} - \frac{1}{b};$$

formulæ which are convenient for computing tabular values.

For negative values of b, in which case  $A_2$  is less than  $A_1$ , it is arithmetically convenient to use the ratio  $A_1/A_2 = m$ , so that m=1/n, and put  $\beta = -b$ , then the preceding formulæ become:—

$$(507)..._{\mathbf{0}}x''_{1}=1-\frac{m}{m-1}+\frac{1}{\beta};_{1}x''_{2}=2-\frac{m}{m-1}+\frac{1}{\beta};_{p-1}x''_{p}=p-\frac{m}{m-1}+\frac{1}{\beta}$$

It may be easily verified that  $p-1x'_p + p-1x'_p = 1$ .

By means of the preceding formulæ Table LXXXI. has been computed: it will serve for readily estimating the position of the centroid vertical for any group by means of the relative magnitudes of the adjoining groups. The determination of that vertical from the relative magnitudes of the groups on either side of any group in question gives results of a fair degree of precision.

To satisfy three groups by means of (497) we have for the value of A in terms of  $A_1$  to  $A_3$ :—

$$(508)....A = \frac{A_1 A_3 - A_2^2}{A_1 + A_3 - 2 A_2}$$

instead of (503): hence we can subtract this quantity from the groups and we then obtain:—

$$(509)$$
.....  $A'_1 = A_1 - A$ ;  $A'_2 = A_2 - A$ ; etc.; etc.

these reduced groups, denoted by accents, conforming to the relation  $A_3/A_2 = A_2/A_1$ .

The value of the average interval is therefore:-

$$(510)..._{0}x'_{p} = \frac{\frac{1}{2}(1+3+...2p-1) A + A'_{1\ 0}x'_{1} + A'_{2\ 1}x'_{2} + .... \text{to } p \text{ terms}}{A_{1} + A_{2} + ..... \text{to } p \text{ terms}}.$$

Results so computed have a high order of precision. If A, and  $A'_1$ , etc., be expressed in ratios to  $A_1+$  etc., as unity, the denominator of course disappears.

TABLE LXXXI.—Abscissæ of the Centroid Verticals of Groups Bounded by the Curve  $Be^{bx}$  and  $Be^{-bx}$ . For the Computation of Average Intervals, etc.

$\begin{array}{c} {\rm Ratio} \\ {\rm A_2/A_1} \\ {\rm or} \\ {\rm A_1/A_2} \end{array}$	Case I.	Case III.	$\begin{array}{c} {\rm Ratio} \\ {\rm A_2/A_1} \\ {\rm or} \\ {\rm A_1/A_2} \end{array}$	Case I.	Case III.	$\begin{array}{c} {\rm Ratio} \\ {\rm A_2/A_1} \\ {\rm or} \\ {\rm A_1/A_2} \end{array}$	Case I.	Case III.
1.0	.50000	.50000	4.0	.61199	.38801	9	.66988	.33012
1.25	.51857	.48143	4.5	.62085	.37915	10	.67682	.32318
1.5	.53370	.46630	5.0	.62867	.37133	11	.68297	.31703
1.75	.54639	.45361	5.5	.63563	.36437	12	.68848	.31152
2.0	.55731	.44269	6.0	.64189	.35811	13	.69346	.30654
2.25	.56685	.43315	6.5	.64757	.35243	14	.69800	.30200
2.5	.57531	.42469	7.0	.65277	.34723	15	.70216	.29784
2.75	.58290	.41710	7.5	.65754	.34246	20	.71672	.28328
3.0	.58976	.41024	8.0	.66196	.33804	25	.73100	.26900
3.5	.60177	.39823	8.5	.66606	.33394	50	.76479	23521

For case II. add unity to the value for case I., and for case IV. add unity to the value for case III.

Applying the various formulæ to the results given on the penultimate line on Table LXXVII. for all first-births, 12 months or more after marriage, the following results are obtained:—

By formula (484), neglecting the correction  $\epsilon$ , 29.06 months (Index). (494), applied through same range, 28.18 (Interval) (495) $27.72^{1}$ (506),, By graduating and using monthly values for the groups up to 48 months  $27.70^{1}$ 

26. Positions of average intervals for groups of all first-births.-The positions of the average intervals (abscissæ of the centroid verticals), computed on the basis of the results shewn on the penultimate line of Table LXXVII., will probably be found approximately true for any population. By means of Table LXXXI., they may be readily found.

TABLE LXXXII.—Average Intervals\* in Months for First-births, for Various Ranges of Interval. Australia, 1908-1914.

Range	Aver-	Range	Aver-	Range	Aver-	Range	Aver-	Range	Aver-	Range	Aver-
of	age	of	age	of	age	of	age	of	age	of In-	age
Int'rval	Value.	Int'rval	Value.	Int'rval	Value.	Int'rval	Value.	Int'rval	Value.	terval	Value
months. 0-1 1-2 2-3 3-4 4-5 5-6 6-7 7-8 8-9 9-10 10-11 11-12	months051 1.52 2.53 3.52 4.52 5.52 6.50 7.49 8.55 9.53 10.52	years. 0- 1 1-2- 3 3- 4 4- 5 5- 6- 7 7- 8 8- 9 9-10 10-11 11-12	months. 7.51 16.35 28.95 39.22 53.39 65.53 77.61 89.63 101.67 113.71 125.73 137.77	years. 12-13 13-14 14-15 15-16 16-17 17-18 18-19 19-20 20-21 21-22 22-23 23-24 24-25	months. 149.76 161.69 161.67 185.73 197.74 209.69 221.68 233.67 245.66 257.67 269.65 281.58 293.49	months. 0-3 3-6 6-9 9-12 years 0-1 1-5 5-10 10-15 15-20 20-25 25-26	months. 1.70 4.65 7.40 10.34 7.51 22.36 81.12 142.95 203.05 261.40 305.43	months. 0- 6 0- 9 0-12 years 0- 5 0-10 0-15 0-20 0-25 0-26	months. 3.68 5.41 7.51 13.07 14.63 15.19 15.38 15.43 15.43	years. 3-1 3-5 3-15 3-20 3-25 3-26 1-5 1-10 1-20 1-25 1-26	month 10.34 17.35 19.60 20.43 20.72 20.79 20.80 25.82 27.13 27.59 27.71

<sup>\*</sup> These will be sensibly true for any distribution at all similar to that shewn in Table LXXVII. and in Table LXXXIII. hereinafter.

The above results have been computed by using graphic graduation<sup>2</sup> where necessary, by means of the values given in Table LXXXI., and by formula (416), p. 201. In general the computed values proved to be sensibly identical. A result intermediate between the extreme values has always been taken, regard being had to the general probabilities of each case.

<sup>1</sup> These last results are the most accurate; the value for the month 11-12 is taken into account in the graduating; in applying formulæ (494) and (495) and (506) it is not considered.

<sup>&</sup>lt;sup>2</sup> It is impossible in the absence of monthly data to determine the position of the centroid vertical with great precision. By graphic graduation conforming to the 11 to 12 months group and to the 1-2, and 2-3 years groups, the result, 16.46 was obtained. By extrapolating the 10-11, 11-12 months group-results, adopting this extrapolation for the year-group 0-1, and conforming to this fictitious year-group and the actual year-groups 1-2 and 2-3, the result is 16.25 by formula (510). Adopting the extrapolated result and the group 1-2 only, gives 15.91; while the exponential curve conforming to the group 1-2 and 2-3 only, gives the result 16.79. The groups 1-2, 2-3 and 3-4, treated by formulæ (508) and (510) give 16.63. After consideration of all the circumstances I have adopted 16.35 as the result which I believe to be nearest the correct value. Similarly the results 28.95, 28.93 and 29.11 were obtained for the group 2-3: of these the first was adopted. were obtained for the group 2-3; of these the first was adopted.

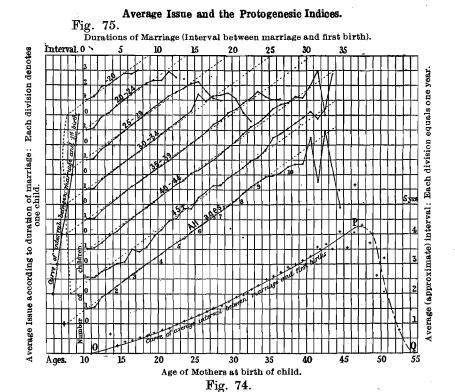


Fig.74.—The lower curve OPQ is the curve of the protogenesic indices (or approximately computed average intervals between marriages and the first-births) according to the age of mother at the birth of the first child.

Fig. 75.—The upper series of lines are graphs of the average number of children born to all mothers under 20 years of age, to mothers of from 20 to 24, 25 to 29, etc., and to mothers of all ages—who come under observation—according to duration of marriage. The fine dots give the crude results. The parallel broken lines indicate that the average rate of increase is nearly independent of the age of the mothers, and is dependent on the duration of the marriage.

27. The unprejudiced protogenesic interval.—The protogenesic interval gives unequivocally a measure of what may be called the modified-fertility of married women, that is fertility as modified by physiological and social conditions, by Malthusianism, etc. It is evident that first births are likely to give the best available indication of the physiological element in fertility; that is to say, the ratio of cases of nuprial-maternity at any age to the total number of nulliparous women, is a better indication of variations with age of physiological fertility, than would be the indication given by later births. But what have been called "prejudiced cases" should obviously be excluded, viz., cases where maternity, being expected, leads to marriage. For this reason the interval obtained by excluding such cases is not only appreciably longer, but also gives a truer idea of the normal probability of maternity, other things being equal. Results were published in New South Wales in 1899, purporting to shew

that, when prejudiced cases were excluded, the "average period from marriage to the birth of a first child" was, for unprejudiced mothers of from 17 to 39 years of age, about 19½ months, individual cases ranging between 18.3 and 21.9 months. 1 In order to definitely ascertain whether there was any justification for the statement, the New South Wales statistics, upon which they were based, were examined and recompiled; the data are given in Table LXXXIII. hereunder.

Table LXXXIII.—Interval between Marriage and First Births occurring later than 9 Months after Marriage.—New South Wales, 1893-98.

	Inte	rval (	m <b>th</b> s.)							Inte	rva	1 7	Zea.	rs.)	,									
Age.	9 to 10	10 to 11	11 to 12	1 to 2	2 to 3	3 to 4	to 5	5 to 6	6 to 7	7 to 8	8 to 9	to	to	to	to	to	to	15 to 16	to	17 to 18	18 to 19	to	22 to 23	
13 14	::	::	::			::		::	::	::	· .	 	·:	  ::	::	  -:		· :	::	::	  ::	 	\  ::	
15 16 17 18 19	3 15 52 134 273	51 137	108	132 380	1 9 37	3	i	i														::		5 54 286 800 1,420
20 21 22 23 24	320 470 544 483 453	425 521 498	292 365 357	1,026 1,181 1,205	172 210 249	41 61 79	11 22 37	6 1 4 17 13	1 6 7 9	 1 1 5	 1 1											• • • • • • • • • • • • • • • • • • • •		1,818 2,439 2,915 2,934 2,589
25 26 27 28 29	419 342 243 232 141	382 294 264 185 145	240 185 153	801 650 549	205 176	83 74	38 32	17 17 34 27 13	10 19 15 15 12	6 4 10 18 9	5 5 2 4 6	2 1 7 5 8	1 1 ··3 3	 2 1 2	i 1 2	::								2,344 2,054 1,700 1,453 1,078
30 31 32 33 34	133 68 52 48 33	131 83 53 47 45	83 62 48 41 31	343 248 209 142 117	124 76 78 66 43	46 32 27 25 16		32 10 19 8 5	16 13 9 8 6	14 7 9 8 1	6 14 6 2	6 7 6 2	3 6 8 4 4	5 5 3 3	3 1 3 3 4	1 4 1 4	 1 2 4	`i  i		 :: i		•••	::	983 643 556 431 333
35 36 37 38 39	33 29 12 10 11	29 25 22 12 8	25 12 9 8 13	95 90 59 58 47	34 32 20 13 15	16 7 8 14	11 12 8 3 5	6 6 7 1	2 4 2 1	4 1 2 3 1	8 4 1 1 2	4 7 2 3 2	5 3 1	3 2	3 4 ·· 1	 2	1 1 	1 2 1 	 i 1	1 1 1 1	`i 	i 		281 246 159 138 118
40 41 42 43 44	 2 3 1 2	3 2 6 3	5  3 2	37 10 17 8 6	15 7 12 3	6 3 3 2 1	2  1	3 1 1 1	i i i	··· 2 1	1 1 1 	1	 i	$\begin{array}{c} 2 \\ 1 \\ \cdots \\ \end{array}$	1  1		2  		3 1 		1 			83 31 49 24 12
45 46	_::			9			·i	::	•••	.: 	i	 <u>:-</u>	<u>::</u>	··	 		<u>::</u>	:: ::	<u>::</u>	· · ·	::  	::  ::	· · ·	12 5
Σ	4,561	4,407	3,075	11229	2,515	928	453	256	158	107	76	70	44	34	30	13	15	6	6	5	2	1	2	27,993

Further, to ascertain whether any material difference existed between the results for New South Wales for the period 1893-8, and for the whole of Australia for the period 1908-14, the latter were also computed, and are shown in the same table. On Fig. 79 the intervals for successive ages are shewn by a light zig-zag line, and for the Commonwealth by a heavy zig-zag line. The two are evidently substantially identical, as the figures in Table LXXXIV. also shew.

<sup>&</sup>lt;sup>1</sup> See note on page 257, hereinbefore.

Table LXXXIV.—Protogenesic Interval or Average Interval elapsing between Marriage and First-birth, for all First-births occurring not Earlier than 9 months after Marriage. New South Wales, 1893-8; and Australia, 1908-14.

Age ] of Mother	Inte	RVAL.	Age of	INTE	RVAL.	Age of	INTE	RVAL.	Age	INTE	VAL.
last Birth- day.	N.S.W.	Aust.	Mother last Birth- day.	N.S.W.	Aust.	Mother last Birth- day.	n.s.w.	Aust.	Mother last Birth- day.	N.S.W.	Aust.
	months.				months.	years.		months.	years.	months.	months
13		13.83*	23	16,10	16.25	33	28.87	30.70	43		49.38
14	_	10.14*	24	16.88	17.20	34	30.10	33.64	44		57.35
15		12.09*	25	17.30	18.23	35	32.21	35.04	45	i	47.49
16		13.65	26	28.28	19.49	36	35,91	36.92	46		58.70
17	13.48	12.72	27	19.71	20.54	37	32.34	38.55	47		
18	13.93	13.46	28	20.91	21.92	38	33.00	43.62	48		
19	14.40	14.05	29	22.07	23.39	39	28.47	42.14	49		
$\bar{2}0$	15.03	14.46	30	24.65	25.42	40	43.88	43.77	50		
21	14.71	14.76	31	25.15	26.28	41		48.57	51	\ . <del></del>	
22	15.04	15.02	32	30.09	28.94	42		49.83	$5\tilde{2}$	l —	

<sup>\*</sup> Depend upon 9, 14, and 68 cases only.

The above table and Fig. 79 indicate that there has been no material change in the interval between marriage and first-birth during the elapsed 15 years, and also that the average period is not constant but is a function of the age when tabulated according to "age of mothers," that is, according to age at maternity. It will be shewn later that when the

TABLE LXXXV.—Approximate Protogenesic Index for (These results are only approximate, the table being constructed from the data in Table

	1								<del>-</del>		-					
Ages	ļ.					Numb	er of e	ach D	uratio	n of M	[arriag	e, the	total	being	1,000,0	000,
of Mothers at Mar- riage.	0-9 months.	9-12 months.	1-2 yrs.	2-3 yrs.	3-4 yrs.	4-5 yrs.	5-6 yrs.	6-7 yrs.	7-8 yrs.	8-9 yrs.	9–10 yrs.	10-11 yrs.	11-12 yrs.	12-13 yrs.	13-14 yrs.	14-15 yrs.
12 13 14	 10 110	0 5 14	4 0 18	0 0 18	0 9 5	0 9 0	0 5 0	0 0 9	0 0 14	0 0 0	0 0 0	0 9	0 0 14	0 0 5	4 0 0	0 0 0
15 16 17 18 19	576 3,832 12,040 25,771 37,328	50 259 1,458 4,559 9,226	$\begin{array}{c} 209 \\ 1,054 \\ 3,417 \\ 7,794 \\ 11,921 \end{array}$	1,968	50 155 382 682 1,118	32 64 227 395 677	27 36 132 236 377	23 32 95 191 277	9 36 82 136 200	18 59 55 118 145	18 14 55 77 127	18 18 64 36 82	18 5 27 23 86	14 18 41 55 32	5 9 14 41 27	0 9 9 41 36
20 21 22 23 24	38,259 <b>44,522</b> 37,997 32,933 25,336	14,249 20,739 <b>27,624</b> 27,510 26,506	16,125 22,225 <b>24,316</b> 24,261 21,988	5,672 6,413 <b>6,954</b>	2,268 2,550 2,482	904 1,040 1,268 1,373 <b>1,432</b>	550 782 <b>800</b> 695 727	459 427 <b>541</b> 455 477	232 345 305 <b>391</b> 327	200 255 <b>264</b> 227 191	127 <b>227</b> 177 191 177	114 118 <b>205</b> 123 145	45 100 77 <b>132</b> 73	91 109 100 105 50	68 82 <b>114</b> 45 59	27 41 32 41 32
25 26 27 28 29	20,054 16,057 11,798 9,822 7,049	21,130 17,735 14,962	20,670 18,419 15,315 12,281 10,221	5,508 4,436 4,113	$2,263 \\ 2,077 \\ 1,618$	1,218 1,182 868 823 650	732 532 577 441 373	377 441 395 323 268	300 323 250 232 195	191 205 177 164 86	136 150 95 86 123	105 145 77 50 64	100 77 82 59 32	77 73 91 27 18	18 45 59 9	$\begin{array}{c} 27 \\ 14 \\ 0 \\ 5 \\ 0 \end{array}$
30 31 32 33 34	5,614 4,090 3,564 2,745 2,048	9,831 6,627 5,499 4,204 3,064	7,549 6,680 5,086 3,918 3,530	1,712 $1,314$	1,154 800 714 577 459	586 423 423 282 314	282 268 259 232 114	259 168 -159 100 82	136 123 77 14 36	132 59 45 36 23	64 32 41 36 14	32 27 27 5	23 9 9 5	14 0 0 0	9 0 9 5	18 0 0 0
35 36 37 38 39	1,768 1,442 943 749 687	2,436 1,977 1,481 1,096 800	2,654 2,054 1,786 1,427 1,114	1,041 786 641 523 286	477 377 300 173 159	200 195 114 91 36	109 68 68 64 ' 18	55 23 32 18	36 32 18 5 9	18 5 14 4 0	19 5 0 0	0 0 0 4 0	0 4 0 0	 0  	; · · · · · · · · · · · · · · · · · · ·	
40 41 42 43 44	450 304 227 151 88	468 282 178 113 50	600 386 295 209 91	318 132 82 55 18	105 45 50 23 14	50 14 9 5 4	14 0 5 5 4	5 4 0 0	5 0 4 0	0 0 0			  			
45 46 47 48 49 50 51 52	46 5 13 0 5 4 0	14 9 5 10 4 0	27 14 9 5 0 4 0	18 5 0 0 0 0	0 5 0	0 0  	9 0  	  		•••						
Totals		259,411		71816	29354	ļ	8,541							920	631	332

tabulation is according to "age at marriage," there is a great approach to constancy of the interval, though the distribution according to interval is very different for different ages.

28. Protogenesic Index based on age at and duration of marriage.—
The protogenesic indexes as determined in the preceding sections, viz., §§ 21, 22, 26 and 27, are based upon the ages at maternity. For certain purposes, however, they might with advantage be based upon the ages at marriage, and for exact results the evaluation of the index would of course require a compilation according to those ages, and cannot be quite satisfactorily deduced from the results given in Table LXXVII. A very fair approximation, however, can be obtained by reconstructing that table (see pp. 252-3), and the simplest form which this reconstruction can take is to treat the results in columns 1-2, 2-3, etc., years as respectively applicable to "ages at marriage, 1 year, 2 years, etc., earlier than that in the age-column. Such a compilation will be sufficiently accurate to disclose the general characteristics of the protogenesic indices for ages at marriage. This has been done in Table LXXXV. hereunder, which is self-explanatory when compared with Table LXXVII.

Australia, 1908 to 1914 based on Age at Marriage.

LXXVII. by moving the successive columns upwards, 1, 2, 3, etc., places respectively).

5-16	1617					21-22			<u> </u>	25–26	9 mths.	Ind Appro Ave	genesic ex, or eximate erage erval.	Proto- genesic Quad- ratic Index.	Ages of Moth's at Mar-
yrs.	yrs.	yrs.	yrs.	yrs.	yrs.	yrs.	yrs.	yrs.	yrs.	yrs.	26 yrs.	Crude.	Smooth'd	(Crude).	riage.
0 0 0	0 0 0	0 0 0	4 0 0	0 4 0	 0 0	 	··· 0	 	· · · · · · · · · · · · · · · · · · ·		12 41 106	134.0 80.9 66.0	134.0 88.0 67.0	159.0 101.9 82.5	12 13 14
9 4 5 9 <b>23</b>	0 4 9 5 23	14 5 9 9 14	0 5 14 9	5 0 14 9	4 0 5 18 14	0 0 5 9 <b>14</b>	0 4 4 4 5	0 0 9 0 5	5 0 4 0 0	0 0 0 9	601 2,167 7,190 16,424 27,406	57.4 33.3 29.5 24.8 23.5	58.0 34.8 28.5 25.3 23.6	81.8 47.8 44.3 35.8 34.0	15 16 17 18 19
36 <b>68</b> 41 36 23	18 36 <b>45</b> 9 27	32 64 18 18 18	27 23 14 23 5	5 14 9 <b>27</b> 5	9 5 4 0 0	14 0 0 9 0	5 5 0 <b>14</b> 0	5 0 0 4 0	0 0 0 0	0 0 5 	39,196 54,645 64,922 65,125 61,525	$\begin{array}{c} 22.9 \\ 22.3 \\ 21.1 \\ 21.0 \\ 20.8 \end{array}$	22.4 21.6 21.2 21.0 20.9	32.6 31.6 29.4 29.2 28.0	20 21 22 23 24
23 14 9 18 14	23 9 5 9 0	18 9 0 0 4	4 0 0 0 0	0 0 4 0	0 0 0 	5  	0				56,667 50,539 42,252 35,220 27,283	20.7 21.2 21.2 21.1 21.4	20.8 20.9 21.0 21.1 21.2	27'8 28.4 28.5 27.7 28.1	25 26 27 28 29
0  	0	0				::				•••	22,621 17,248 14,060 10,728 8,882	21.3 21.1 21.7 21.2 21.6	21.3 21.4 21.4 21.5 21.5	27.9 26.6 27.8 26.7 26.5	30 31 32 33 34
::			   	     			::				7,045 5,526 4,454 3,405 2,427	21.9 21.4 21.5 21.2 19.8	21.6 21.6 21.5 21.4 21.2	26.7 25.9 25.8 25.2 22.9	35 36 37 38 39
											1,565 863 623 410 181	21.8 19.5 20.7 19.9 20.8	21.0 20.7 20.5 20.4 20.0	25.2 22.0 23.9 22.4 24.1	40 41 42 43 44
				     							117 38 18 10 10 8	19.5 20.0 14.3 14.3 10.5 14.3	19.3 18.3 17.0 15.4 13.5 11.3 8.8 6.0	24.6 22.9 14.7 14.7 10.5 14.7	45 46 47 48 49 50 51
332	221	232	137	105	59	56	41	23	9	14	651,563				Totals

Much more accurate results would be secured by that reconstitution of the data, which would be possible if monthly or quarterly graduations for at least the first 3 years after marriage were used. Such graduations would have to be both for the horizontal and vertical values, and when effected, the sub-divided numbers would admit of a new table being compiled, giving with considerable exactitude the required numbers of births occurring after various durations of marriage, borne by women of various ages at marriage (instead of ages at maternity). The general characteristics of the values determined from such a table will, however, not differ materially from those in the table pp. 270, 271.

In the final columns of Table LXXXV. are given the crude and smoothed protogenesic indexes or approximate of protogenesic intervals according to age, with the argument "age at marriage." These are quite different in form from those deduced with the argument "ages at maternity." The values exhibit considerable regularity and require relatively little smoothing. As might be expected a priori, the interval decreases rapidly as the age at marriage increases, until the age 20 is reached, when it is 21 months. It remains sensibly constant till age 46, and then rapidly diminishes. It is evident that it must necessarily have a small value at the end of the child-bearing period.

The protogenesic index, or the protogenesic interval, determined according to "age at marriage," is perhaps to be preferred to one or the other based on the "age of mothers" (i.e., age at maternity). The average "period elapsing between marriage and the birth of the first child of post-nuptial conception" is evidently not the same for all women marrying at ages below 40 years, as had been stated, but is a function of age, and is very nearly constant for a long period, viz., from about 22 to 45 years of age. The maximum frequency is about age 23.4 or 23.5, but cannot be very accurately ascertained without a special compilation.

29. Protogenesic quadratic indices and quadratic intervals.—The fact that the protogenesic indexes or the protogenesic intervals are sensibly identical through a wide range of ages, notwithstanding the "scatter" of the distributions varies enormously, necessitates the adoption of a second and different index, or of a second and different type of "interval." This will of course be of the nature of a higher moment since the higher the power the greater the influence of the distribution on the product. It will in most cases be sufficient to employ the second power of the "duration of marriage," and to use the quadratic index, viz., that

<sup>&</sup>lt;sup>1</sup> T. A. Coghlan, "Childbirth in New South Wales," 1899, p. 26, says: ".... but where a marriage proves fertile, as the following table shews, the period elapsing from marriage to the birth of the first child of post-nuptial conception averages the same for all women marrying at ages below 40 years. This average period is 19.4 months, ranging between 18.3 and 21.5 months." In the table referred to the results are grouped under "age of mother," not under "age at marriage," but the text might suggest that what is implied is "age of mother at marriage" (age of brides). The table shews that from age at marriage 21 to 45 the average interval is sensibly constant, and only slightly larger than that deduced by Coghlan if in his Table VIII. "age at marriage" be substituted for "age of mothers."

analogous to the radius of gyration in mechanics. That is, we shall require the value of G where its square is given by:—

$$(511)....G^2 = \frac{\int x^2 f(x) dx}{\int f(x) dx}$$

When f(x) is a rational integral function (a + bx + etc.), this gives—

$$(512)...._{0}G_{x}^{2} = \frac{1}{3}x^{2} + \frac{bx^{3} + \frac{16}{15}cx^{4} + dx^{5} + \frac{96}{105}ex^{6} + ...}{12a + 6bx + 4cx^{2} + 3dx^{3} + \frac{12}{5}ex^{4} + ...}$$

a formula which is appropriate when the graphed areas extend from the origin. The values of b, c, etc., can be ascertained from the group-totals, see, for example, by formulæ (195) to (197d), etc., pp. 67, 68. When the graph-totals are not continuous to the origin, the solution is a matter of integrating between the same limits in both numerator and denominator. If the limits be  $x-\frac{1}{2}k$  to  $x+\frac{1}{2}k$ , that is, if the middle of the group-range be taken as the value x in the formula, then it is easy to shew that

$$(513)....G_m^2 = \frac{a(x^2 + \frac{1}{12}k^2) + b(x^3 + \frac{1}{4}k^2x) + c(x^4 + \frac{1}{2}k^2x^2 + \frac{1}{80}k^4) + \text{etc.}}{a + bx + c(x^2 + \frac{1}{12}k^2) + d(x^3 + \frac{1}{4}k^2x) + \text{etc.}}$$

 $G_m$  being the radius of gyration of the figure standing on the range referred to, viz.,  $x \pm \frac{1}{2}k$ . This formula can be readily recast into arithmetically convenient forms.

When the function is a simple exponential one  $(Be^{bx})$ , we have :—

$$(514)..._0G_1^2 = \frac{n}{n-1}\left(1-\frac{2}{b}\right) + \frac{2}{b^2}; \text{ or generally}$$

$$(515)..._0G_p^2 = \frac{n}{n^p-1}\left(p-\frac{2}{b}\right) + \frac{2}{b^2}$$

in which  $n = e^b$ . These are also suitable only for the figure starting from the origin. When the limits of the integral are p and q, we shall have

$$(516) \dots_{p} G_{q}^{2} = \frac{n^{q} q \left(q - \frac{2}{b}\right) - n^{p} p \left(p - \frac{2}{b}\right)}{n^{q} - n^{p}} + \frac{2}{b^{2}} = \frac{n^{t} t^{2} - n^{s} s^{2}}{n^{t} - n^{s}} + \frac{1}{b^{2}}^{*}$$

in which last expression s = p - 1/b and t = q - 1/b. When the values of the squares of the several "radii of gyration" have been obtained, the radius of gyration of the whole series of groups is given by:—

(517).. 
$$G_0^2 = (A_1G_1 + A_2G_2 + \text{etc.})/(A_1 + A_2 + \text{etc.}) = \Sigma (AG)/\Sigma A$$
  
A<sub>1</sub> denoting the number in group 1,  $A_2$  in group 2, and so on.

The protogenesic quadratic index is computed in a manner analogous to that for computing the simple protogenesic index: that is by multiplying the square of the middle value of the successive yearly ranges of

<sup>\*</sup>This may be seen by adding  $1/b^2$  to the first term, thus making the terms in brackets perfect squares when multiplied by q and p respectively; and then multiplying both numerator and denominator by  $e^{-\frac{1}{b}}$ .

duration by the number in the group: that is in formula (491)  $x'^2$ ,  $x''^2$ , etc., is written instead of x', x'', etc., x', etc., here denoting the durations of marriage.

30. Correction of the protogenesic interval for a population whose characters are not constant.—When a population is increasing, all other facts remaining the same, the first-births, after a given duration of marriage (i), are drawn from a smaller population than are those for any lesser duration and presumably also from a smaller number of marriages. For comparative purposes, therefore, they need to be "corrected" so as to agree with what would be shewn by a constant population. Thus, were the ratio of first-births to marriages constant, it might very properly be assumed that the number of first-births to be expected would vary roughly as the ratio of the total marriages (marriages at all ages) for the period i years earlier, to the total number for the period being compared. Thus, if  $J_{-i}$  be the total number in the former case, and J the total number in the latter, the correction to be applied would be i:—

$$(518)....1 + c_i = J / J_{-i}$$

a quantity ordinarily greater than unity, *i.e.*,  $c_i$  is ordinarily a positive factor since populations generally are increasing.

We may, however, envisage the problem more rigorously as follows: Let M, with suffixes shewing the age, denote the number of mothers of first-born children, and J the number of women marrying, from which they were derived. Then in the case of a "constant population," in which also the relative frequencies of nuptial first-births were constant, the former number would bear a constant ratio to the latter, for any age in question; that is to say, for any age and at any time we should have  $M/J=\mu$ , a constant. Actually this ratio, however, is not quite constant, hence, rigorously, the number of nuptial primiparæ must be taken as:—

$$(519)...M_x = {}_{x}\mu_t J_x = J_x \cdot f(x,t)$$

In short we cannot take the marriages as the basis of the correction, but we should take what may be called their *Malthusian equivalent*; that is the number of marriages so reduced (or increased) as to be of equal productive efficiency: thus,  $\mu J$  must replace J, and  $\mu$  is not a constant. The character of  $\mu$  may not be simple; it is probably a function also of the interval elapsing before birth, *i.e.*,

$$(520)\ldots\mu = f(x, i, t).$$

The form and constants of this function can be ascertained only by computing  $\mu$  for differing ages with different intervals and at different times. Thus, instead of (518) we should write:—

$$(521)....1 + c_i = \mu' J/(\mu'_{-i} \cdot J_{-i})$$

<sup>&</sup>lt;sup>1</sup> This was pointed out by Sir (then Mr.) T. A. Coghlan, Childbirth in New South Wales, 1899, p. 26. He used this correction, which, however, would not be completely satisfactory if the "Malthusian coefficient" were increasing.

in which  $\mu'$  denotes:—(a) the value of  $\mu$  for a given age and interval, (when J and c are to be ascertained for a given age and interval), or (b): its value for the total for all ages and for a given interval, (when J and c are required for the total of all marriages). For Australia the ratio M/J is known only since 1893. During the period 1893-1914 it ranged between .790 in 1903, and .901 in 1912, for first-births and women of all ages (see hereinafter). As this average 0.0156 per annum for the 9 years interval between the years mentioned, it is of the same order as the yearly increase of population, and in the case cited would increase the correction. It may fall or rise 0.03 in one year. This term may be neglected, however, because its effect is relatively negligible when the correction is large, so that it has very little influence on the result computed by ignoring it. This is shewn by the results in the following table:—

TABLE LXXXVI.—Correction to the Computed Average Interval between Marriage and First-birth when Population is Increasing.

Factors to be multiplied into the	When	the increa	se per un	it per ann	um is,
computed average interval between marriage and first-birth when the correction for increase is ignored	0.010	0.015	0.020	0.025	0.030
See (511) to (514).	Multiply (	he compu	ted interv	al by the	factor:
(a) When the first-births after 12 months are taken into account		1.0294	1.0395	1.0500	1.0604
(b) When the first-births after 9 months are taken into account		1.0199	1.0267	1.0338	1.0408
(c) When all first-births are taken into account	1.0083	1.0125	1.0168	1.0213	1.0257

It is to be remembered that the epoch to which the results refer is (sensibly) the middle of the year of observation, and that the intervals are 0, 1, 2, etc., years.

Since the relative numbers for different intervals will probably differ from those of Australia but slightly for most countries, we obtain the following very simple rules:—(i) If the ratio of first-births to marriages increase continually at the rates indicated in Table LXXXVI., or (ii.) if that ratio be constant, and the number of marriages increase continually at the rates in the table, or (iii.) if the sum of the ratios in question be as indicated in the table, then-

correction to the interval for all first-births occurring more than twelve months after marriage is

For all first-births occurring more than nine months after marriage the correc-

all occurring first-births after marriage, the correction is

in which r denotes the rate of increase.

Twice the rate of increase. 1 + 2r

The rate of increase plus one-third.

 $1 + 1\frac{1}{3}r$ 

The rate of increase less one-sixth.  $1 + \frac{5}{6}r$ 

31. Proportion of births occurring up to any point of time after marriage.—The rate of occurrence of first-births, for different intervals after marriage, is well shewn by giving the proportion of the whole which have occurred up to any given time. The following table furnishes the proportions in question:—

TABLE LXXXVII.—Shewing Proportion of Nuptial First-births occurring up to any point of time after Marriage.

			point	of t	ime ai	ter M	larrias	ge.				
AGE OF					UP	ro End	of M	ONTH,				
Mothers.	1	2	3	. 4	5	6	7	8	9	10	11	12
15 20 25 30 35 40	.0699 .0262 .0099 .0070 .0080 .0120 .0128	.1832 .0597 .0204 .0140 .0156 .0201 .0281	.3525 .1071 .0367 .0229 .0284 .0324 .0510	.4581 .1685 .0569 .0362 .0395 .0466 .0536	.0810 .0493 .0562 .0606	.7189 .3341 .1176 .0685 .0723 .0748 .0714	.8245 .4398 .1659 .0945 .0958 .0977	.8804 .5234 .2076 .1240 .1216 .1161 .1020	.8944 .5721 .2577 .1631 .1485 .1340 .1122	.9363 .6641 .3932 .2761 .2338 .1884 .1658	.9720 .7355 .4958 .3677 .3083 .2376 .1888	.785 .5683 .4346 .3577
13-52	.0160	.0345	.0614	.0953	.1365	.1872	.2502	.3027	.3484	.4595	.5461	.6078
13-52 Proportion of first year's births during month Proportion of first year's births up to end of months	.0264	,0304 .0568	.0443	.0557		.0834	.1037	.0863	.0753	.1827	.1424	.1017
AGE OF				U	р то Е	ND OF	YEAR.					
Mothers,	2		3	4	5	e	3	10	15	20		26
15 20 25 30 35	1.0000 .9634 .8508 .7278 .6455	1 .99 3 .94 3 .84	928 402 458 331	.9985 .9729 .9043 .8223	.9995 .9863 .9367 .8614	.99 .95	33 65	.0000 .9996 .9928 .9562	1.0000 1.9998 .9932	1.000 .99	00   97   1.	  (22) .0000
$\begin{array}{ccc} 40 & \dots \\ 45 & \dots \end{array}$	.5704 .4974		052 276	.7842 .7270	.8314 .7908			.9202 .9107	.9676 $.9541$	.99 .97	16   1.	(25) .0000 .0000
13-52	.8555	.95	273	.9567	.9716	.98	801	.9943	,9988	.99	98 1.	.0000
13-52 Proportion of first year's births dur- ing month Proportion of first year's births up			. ;							,		
to end of month	1.4075	1.52	254   1	.5739	1.5984	1.61	25 1.	6359	1.6431	1.644	18 1.	6451

This table is interpreted as follows:—Taking the upper line, 13-52, 0.0160 of all nuptial first-births occur within one month of marriage, 0.3484 occur before the end of the ninth month after marriage, and 0.6078 before the end of the twelfth month. Again, of the nuptial first-births occurring, with women of all ages, during the year of marriage, 0.5732 are born before the end of nine months, and all births exceed those born during the first twelve months by only 0.6451. This is shewn on the last line of the table.

32. Range of the gestation period.—In order to accurately estimate the cases of first-births properly attributable to pre-nuptial insemination, the range of the normal gestation-period must be taken into account as

well as the frequency of premature live births. Contrary to popular opinion this gestation-period has a considerable range.1 The following data represent the best available results:

TABLE LXXXVIII.--Relative Frequency of Births after Different Periods, between the last Menstruation and Parturition.

			Authori	TIES.		
Duration Days.	Reid.* 500 Cases.	Hannes.† 561 Cases.	Hannes.‡ 314 Cases.	Hannes. 875 Cases.	Various§ 51 Cases.	Reid, with Hannes.
241-250	56	36	16	28	?	41
251-160	59	37	13	29	20	44
251-170	150	141	111	• 130	210	140
∴71 <b>–280</b>	317	325	366	340	510	329
Maximum						
(days)	(277.77)	(277.73)	(277.02)	(277.42)	(274.64)	(277.58)
281-290	269	271	258	267	`160	268
291-200	97	121	118	120	100	109
301-310	24	50	76	59	. ?	41
311-320	18	14	22	17	?	18
321-330	10	5	19	10	?	10
Total Average¶	1,000	1,000	1,000	1,000	1,000	1,000
Duration	277.2	279.2	281.9	280.3	276.5	278.8

NOTE.—The cases for 241 to 251, 316-330, have been obtained by extrapolating Reid's curve.

in the original calculation.

† Zeit. f. Geburt und Gynäk. LXXI., 1912, p. 524. Die körperliche Entwicklung der Frucht in ihrer Beziehung zur berechneten Schwangerschaftsdauer. Walther Hannes. Children 3000 to 4000 grammes weight.

‡ Same authority, children above 5000 grammes weight.

§ Interval reckoned from coitus, certain. These i clude 51 cases reported by Desormeaux, Girdwood, Montgomery, Rigby, Lockwood, Lee, Dewers, Beatty Skey, McIlvain, Ashwell, Clay and Reid.

The average durations indicated are not exactly identical with the maximum frequency, since the frequency curves are very slightly asymmetric.

If Hannes' cases are combined with Reid's, a total of nearly 1400 is obtained. If the result be "smoothed," so as to agree with the final column of Table LXXXVIII., the result shewn in Table LXXXIX. on next page is obtained.1

<sup>\*</sup> See Hart, Edinburgh Medical Journal, 1914, New Ser. XII., p. 401; also Journ. Edin. Obstetr. Soc., XXXVIII., pp. 107-134; 1912-3. Biometric analysis of some insemination-labour and menstrual-labour curves in certain mammalia. The distribution of Reid's results according to the normal curve of probability for a table of frequency is unquestionably unsatisfactory, as an examination of the original data will shew. The distribution does not conform to the normal curve. The average is given as 278.3; it should be 278.84; there is an arithmetical mistake in the original calculation.

\*\*Point Geburt and Gynäk, LXXI., 1912. p. 524. Die körnerliche En-

<sup>1</sup> Other values are as follows:—Hippocrates, περὶ ὀκταμήνου, generally within 280 days; Hensen, 128 cases, 272.5 days after coitus; see Handbuch der Physiologie by Hermann, VI., 2., p. 73, 1881; M. Zöllner, after menstr., first-births 279.1, second births 282.0; see Zur Kenntniss und Berechnung der Schwangerschaftsdauer, Jenenser Dissertation, 1885, p. 6. Hasler, 195 cases, 281.0; after coitus 665 cases, 272 days; Glusing, after menstr., 279.6; Würzburger Dissertation, 1888, p. 15; Voituriez, 274.8 after menstr. Thèse de Paris (Lille), 1885, p. 62; Winckel, 274.8, Lehrbuch d. Geburtshülfe, p. 78, 1889; Ahlfeld, 270.4 after coitus, Monatschr. f. Geburtskr u. Frauenkr., XXXIV., p. 304. 1869.

TABLE LXXXIX.—Shewing the Frequency per diem per 100,000 Births occurringbetween the 240th and 332nd day after the Termination of the Menstrual Period.

Day	No.	Ratio of Aggre- gate.	Day	No.	Ratio of Aggre- gate.	Day	No.	Ratio of Aggre- gate.	Day	No.	Ratio of Aggre- gate.	Day	No.	Ratio of Aggre- gate.
240	297	.00297	260	675	.09012	280	3,429	.56930	300	657	.93538	320	111	.99424
241	303	.00600		733	.09745		3,318	.60248	301	597	.94135	321	101	.99525
242	310	.00910		807	.10552		3,196		302	546	.94681	322	91	.99616
243	318	.01228		911	.11463		3,014	.66458	303	496	.95177	323	81	.99697
244	327	.01555	264	1,052		284	2,847	.69305	304	455	.95632	324	71	.99768
245	338	.01893	265	1,305	.13820		2,676	.71981	305	420				.99829
246	349	.02242	266	1.548	.15368	286	2,504	.74485	306	389		326	-51	.99880
247	361	.02603		1,784	.17152		2,332	.76817	307	361	.96802		40	.99920
248	374	.02977	268	2,015	.19167	288	2,160	.78977	308	334			30	.99950
249	388	.03365		2,246	.21413		1,988	.80965		304			20	.99970
250	404	.03769		2,470		290		.82781	310	277	.97717	330		.99985
251	420			2,689	.26572		1,644	.84425	311	252			10	.99995
252	437	.04626		2,913				.85902		227	.98196			1.00000
253	455	.05081		3,132		293	1,320	.87222	313	207	.98403		0	• •
254	474			3,420	.36037	294	1,189	.88411	314	188	.98591	240		• •
255	496	.06051	275	3,455	.39492	295	1,077	.89488		171	.98762	to	100,000	••
256	521	.06572	276	3,501	.42993	296	976	.90464	316	156		333		
257	551	.07123	277	3,511	.40564	297	885	.91349	317	143	.99061			
258	587	.07710	278	3,506	.50010	298	804	.92153		131	.99192			
259	627	.08337	279	3,491	.53501	299	728	.92881	319	121	.99313			

Maximum frequency occurs on the 277.67th day. Average (240 to 332 days) = 279.28 days.\*

It would appear from these results that the most frequent interval between the termination of menstruation and parturition, and the average interval, may be regarded for practical purposes as identical, and may be taken as 278 days on the average for births of children of ordinary weight, and that only 2 or 3 days need to be added in the case of the birth of heavier children. For first-births the interval is about 3 days shorter. From insemination to parturition the interval is slightly shorter, perhaps 5 or 6 days on the average. In view of social custom, however, the interval for first-births may be taken as say about 14 days longer than the 278, or about 292 days in all. Making allowance for live births occurring after 210 days from insemination, and for the fact that 40 per cent. of births occur between the 261st and 278th day from the last menstruation, (see Table LXXXIX.), we may take 274 days, or 9 months, as the period to be rejected as uncertain as regards post-nuptial conception.

The frequency-curve for the interval between the termination of menstruction and parturition is curve E on Fig. 76, see later, page 284.

33. Proportion of births attributable to pre-nuptial insemination.—
It is evident, from the preceding table, that there is a certain period during which it is not possible to ascertain what proportion of births should be regarded as attributable to pre-nuptial insemination.<sup>1</sup> The numbers

<sup>\*</sup> If the average date be found in the usual way (i.e., from the weighted mean), it will prove to be 278.78. But the births occurring on the nth day range between n and n+1, hence the average is about  $n+\frac{1}{2}$ , consequently the 278.78th day is from 278.78 to 279.78; hence the average interval is 279.28 about.

¹ T. A. Coghlan in 1899 based his computations on the assumption of a 9-months interval, see Childbirth in New South Wales. He points out that in the years 1893-8, the nuptial first-births registered were 41,384, of which 13,366, or 32.3 per cent., were "due to pre-nuptial conception." It may be observed that pre-nuptial insemination may have characterised some cases where birth occurred in the tenth or even eleventh month after marriage, and a small number of births may be attributable to cases of post-nuptial insemination from 200 to 240 days after marriage, and a considerable number from 240 to 270 days. However, the percentage he deduced for New South Wales in 1893-8 seems, on the whole, to be confirmed by the present investigation for Australia, 1908-14.

per million nuptial first-births for women of all ages born during various intervals after marriage are shewn on the penultimate line of Table LXXVII.

By plotting the groups of first-births occurring monthly from 1 to 12 months, and drawing a continuous curve giving the same totals, results are obtained analogous to those shewn on Figs. 76 and 77. On the former figure the part of curve A, marked f, g, g', h, denotes the boundary of the groups, which may be attributed to pre-nuptial insemination. The curve i, i', j shews the boundary of the groups which may be attributed to post-nuptial insemination. On Fig. 77 the curve k, l, l', m, denotes the pre-nuptial insemination quota, and the curve n, n', o, p, the post-nuptial quota; see page 284.

By fixing the position of that part of the curve shewn by the dotted lines in the figures referred to, it would appear that about 0.634 of the births occurring during the 9th month after marriage are to be attributed to pre-nuptial insemination. Thus, about 0.952 of the first-births occurring within 9 months of marriage are due to pre-nuptial insemination. This is equal to 0.546 of all first-births occurring during the year of marriage, and 0.332 of all first-births, in every case for women of all ages. These ratios, it will be seen from Fig. 73, are a fairly definite function of the age of the mothers; and this function could be ascertained by treating the group-results given in Table LXXVII. in the manner above described.

34. Issue according to age and duration of marriage.—The recording of the number of children borne by married women of various ages, and after various durations of marriage, furnish data of value in any attempt to ascertain the law of increase "according to age and duration of marriage." But it is to be kept in view that the immediate results from such data apply only to those who thus, through maternity, come under observation, and does not apply to married women generally. That is to say, if averages be formed these averages are not averages for all married women of the given ages and durations of marriage. During the seven years, 1908-1914, 805,015 mothers came under observation in Australia, their total issue being 2,675,291, or an average of 3.3233 each. The results are shewn in Table XC. hereunder, the averages being found as follows:—

Let  $m_x$  denote the mothers of age-group x - k/2 to x + k/2, and of duration of marriage i - 1 to i, and let the total issue of these be  ${}_iC_x$ ; then the average,  ${}_ic_x$ , is given by :—

$$(522)\ldots c_x = {}_{i}C_x / {}_{i}m''_{x}$$

and these are the averages which have been tabulated.2

¹ The attributing of the whole of the births occurring during the 9 months after marriage to pre-nuptial insemination, gives a result somewhat too great. Nevertheless it is clear that for practical purposes it is a satisfactory rule for eliminating the so-called "prejudiced" from the "unprejudiced" cases, to assume that, on the average, births occurring less than 9 months after marriage are "prejudiced."

<sup>&</sup>lt;sup>2</sup> The original data will be found in the Population and Vital Statistics of Australia for the years 1908-1914, Bulletins 14, 20, 25, 29, 30, 31 and 32.

TABLE XC.—Shewing the Average Number of Children Born to those who Bear during Varying Intervals after Marriage, based upon the Experience of Australia during the Years 1908-1914.

Dura- ation		<del></del>		Age-grou	ps. (Ag	e au Du	on or has	t Child.)	m 4 1 4	
of			25 20						Totals, A	II Ages.
Mar- riage.	-19.	20-24.	25-29.	30-34.	35-39.	40-44.	45-	All Ages.	Mothers.	Issue.
Years.			A	VERA	E NUM	BER O	F CHIL	DREN.		
$0-1 \\ 1-2 \\ 2-3$	1.006 1.250 1.925	$1.010 \\ 1.157 \\ 1.882$	1.016 $1.085$ $1.747$	1.030 1.087 1.700	1.051 1.089 1.627	1.029 $1.113$ $1.454$	1.142 $1.151$ $1.545$	1.013 1.125 1.802	$134,171 \\ 61,213 \\ 64,229$	135,996 68,906 115,759
3-4 4-5 5-6	2.145 2.466 2.791	$2.171 \\ 2.622 \\ 3.020$	2.087 2.520 2.919	$2.0\overline{39}$ $2.441$ $2.825$	1.997 2.401 2.803	1.923 $2.207$ $2.670$	$\overline{\substack{1.786 \ 2.041 \ 2.153}}$	2.107 2.525 2.906	70,317 59,407 53,275	148,160 150,009 154,836
6-7 7-8 8-9 9-10	*2.750 3.000	$3.401 \\ 3.776 \\ 4.105 \\ 4.292$	3,339 3,731 4,126 4,514	3.194 3.576 3.954 4.330	3.216 3.544 3.883 4.271	3.038 3.447 3.820 4.149	3,000 2,846 3,142 3,940	3.290 3.655 4.018 4.374	47,250 41.713 37,115 32,170	155,476 152,461 149,129 140,725
10-11 11-12 12-13 13-14		*4.347 4.950 4.571	4.910 5.256 5.541 5.790	4.705 5.122 5.513 5.868	4.600 4.965 5.329 5.725	4.619 - 4.954 5.319 5.608	4.318 4.931 5.037 5.761	4.726 5.091 5.443 5.718	29,607 25,887 23,372 20,339	139,942 131,795 127,226 117,691
14–15 15–16 16–17			$\frac{6.131}{*6.24}\\5.59$	6.269 7.434 6.967	6.091 6.453 6.859	6.056 6.324 6.688	5.721 6.493 6.844	6.156 6.494 6.844	17,572 15,217 13,271	108,160 98,827 90,836
17-18 18-19 19-20	••	••	5.16 5.00	$\frac{7.239}{7.371}$	7.401 7.679 8.018	6.985 7.431 7.865	7.282 7.291 7.775	7,193 7,575 7,926	10,073	83,539 76,308 67,530
20-21 $21-22$ $22-23$ $23-24$	• • • • • • • • • • • • • • • • • • • •			$7.111 \\ 6.192 \\ 5.60$	8.418 8.824 9.154 9.609	8.282 8.750 9.230 9.503	8.168 8.449 8.962 9.171	8.329 8.751 9.191 9.483	5,988 4,726	61,839 52,403 43,437 33,770
24-25 25-26	••	•••	•••	16.00	9.265 *9.053	9.973 9.973 10.450		9.884 *9.932	2,664 1,809	26,330 17.967
26–27 27–28 28–29 29–30				• •	9.105 7.000	10.730 10.860 11.260 11.210	11,480	10.16 10.54 10.71 10.75	1,146 643 383 192	11,637 6,781 4,102 2,064
30-31 31-32			••			12.00* 13.00	*12.220 11.770	12.51 9.51	77 45	963 428
32–33 33–34 All'Dura-	1.202	1.760	2.643		 	10.00	12.460 14.80	12.94 7.80	. 17 5	220 39
tions Totals all dur'tions	1.402	1.760	2,043	3.837	5.341	6.997	8.565	3,3233		
Mothers Issue	$29,371 \\ 35,292$	185,694 326,868	$239,066 \\ 631,954$	181,191 695,220	$118,310 \\ 626,641$	46,705 326,095	4,678 40,181	$\substack{805,015 \\ 2,675,291}$	805,015	2,675,291

<sup>\*</sup> Owing to the limited data, the values are not reliable for the age-group 45, nor for the values shewn by the asterisks and those for greater durations of marriage.

The table shews that, for all ages, the average total issue of married women, with various durations of marriage, who each year appear in the Australian maternity records, increases approximately at the rate of one child in 2.745 years, or 0.3643 of a child per annum. The results are graphed in Fig. 75, p. 268. The parallel dotted lines in the figure shew that the rate of increase of the total issue according to the duration of marriage is identical for all ages, at least for the greater part of the range of duration. That the graphs approximate so closely to straight lines, and, moreover, to parallel straight lines, is remarkable. These lines may be defined by equations:—

$$(523).....c'_x = a_x + bi = 0.6667 + 0.3643i$$
, approximately;

<sup>&</sup>lt;sup>1</sup> This characteristic can no doubt be deduced, but no explanation of an elementary nature can be offered.

in which only ax is dependent on the age of the mothers, being about  $\frac{2}{3}$ , and b is constant for all ages. The more exact values of a are given in Table XCI. hereinafter.

The results shewn in Fig. 75, p. 268, and detailed in the table referred to, can be referred in a general way also to the age-groups, that is to say, if  $\gamma_x$  denote the average issue for mothers of a given age-group for all durations of marriage, then the number is as shewn in Table XCI. The average ages for these age-groups, as shewn in the table, are found on the supposition that the distribution of the cases of nuptial maternity occurring during the period 1907-1914, in Australia, apply. This distribution is given in Table LXXIII., p. 242, and the average ages of each age-group have been calculated strictly<sup>1</sup>: these are as given hereunder.

TABLE XCI.—Shewing the Total Issue for Mothers in various Age-groups, for All Durations of Marriage: the Constants of Formulæ for Computing this Number, and the Differences between the Observed and Computed Numbers. Australia, 1908-1914.

Age-group . Average age .	: ::	-19 18.92	$\frac{20-24}{22.87}$	$\begin{array}{c} 25-29 \\ 27.46 \end{array}$	$\frac{30-34}{32.35}$	35-39 37.29	40–44 41.91	45- 46.29	13-52 ••
Average num children, all tions of ma Smoothed resu	l dura- rriage	1.202 1.242	1.760 1.751	2.643 2.636	3.837 3.895	5,341 5,413	6.997 6.994	8.565 8.764	3.3233
results are equivalent	Crude) Smooth- ed)	1.37	2,90 2,88	5.33 5.31	8.60 8.76	12.73 12.93	17.28 17.27	21.58 22.13	Crude Smoothed
Values of $A_x$ for group . Value of $b$ .	or age-	.6515 .3643	.7909 .3643	.7778 .3643	.6921 .3643	.6646 .3643	.5977 .3643	.4939 .3643	.7029 .3643
	gi 1	1.016—.010	€ 1.155—,145	1.052—.036	1.056—.026	$\frac{\epsilon}{1.029 + .021}$	0.962 + .067	0.858+.284	1.067—.05
Calculated Values of	duration.	1.380130	1.520363	1.416—.331	1.421,334	1.393304	1.326213	1.223072	1.43230
Ax + bu when $u =$		1.744 + .181	1.884—.002	1.781—.034	1.795095	1.758—.131	1.691—,237	1.587042	1.796 + .006
and the	<b>5</b> 4	2.109 + .036	2.258087	2.155068	2.159—,120	2.122125	2.055132	1,951—,165	2.160 053
varue or et	Year 2	2.473007	2.622000	2.519 + .001	2.524083	2.486085	2.419—.212	2.315274	2,524+.00

<sup>†</sup> The smoothed result conforms to a rational integral equation of the fourth degree.  $\epsilon$  is the quantity which, added to the tabular value (calculated), makes it identical with the data.

The smoothed results for the average number of children, according to age, for all durations of marriage, are given by:—

$$(524).....\gamma_x = 1 + b\chi + c\chi^2 + d\chi^3 + e\chi^4;$$

in which  $\chi = x-13$ , and the values of which for  $2\frac{1}{2}$  years' intervals are as follow:—

TABLE XCII.—Shewing the Effect of "Age of Mothers" upon the Total Issue for All Durations of Marriage. Australia, 1908-1914.

Ages at birth of last child, in years Children*	$\begin{smallmatrix} 13\\1.000\end{smallmatrix}$			20.5 1,413					33 4.070		38 5.650				
Difference for 21 yrs	0.	019 0.	141 0.5	253 0.	357 0.	451 0.	539 0.	618 0.	692 0.	759 0.	821 0.	878 0.	932 0.	981	1.029

<sup>\*</sup> That these are given by a curve of the fourth degree, can be readily seen by taking the values for 13, 18, 23, etc.

<sup>&</sup>lt;sup>1</sup> That is, the numbers are referred to the exact average for the year of age, not merely to the age for the middle point.

In the above table the differences for  $2\frac{1}{2}$  years shew that for all durations of marriage, differences of age have much less influence than differences in duration. To obtain this relationship exactly, it is necessary to compile for each age, and for given durations of marriage the total issue. For all age-groups the general result is 0.3643 a child per year, that is 0.9107 for  $2\frac{1}{2}$  years. From the above table, however, it would appear that this value is not attained for "all durations of marriage" until, almost exactly, age 40.

Such results as are referred to, are dependent upon the combination of two things, viz.:—(a) The age-effect proper, and (b) the fact that for the higher ages the average of the durations of marriage are greater, and thus, throughout the range of observation, the conditions are not homogeneous.

- 35. Initial and terminal non-linear character of the average issue according to duration of marriage.—An inspection of Fig. 75, p. 268, and the results given in the preceding table, shew that there is a more or less systematic departure from linearity at the terminals of the graphs representing "issue according to duration of marriage." The table reveals the fact that the character of the differences, according to age, and for various durations of marriage, between the values according to formula (523), and the individual results are as follow:—
  - (i.) For the first year of duration of marriage, the computed total issue for ages under 35 is too great, and for ages over 35 is too small.
  - (ii.) For the second year of duration of marriage, the computed total issue is *invariably* too great, the maximum difference being at about age 24.
  - (iii.) For the third year of the duration of marriage, the computed issue is less than the actual for the younger ages, but soon becomes greater, the maximum difference occurring at about the age 43 or 44.
  - (iv.) The same remarks apply to the fourth year of the duration of marriage with the exception that the age is later than 45.
  - (v.) In the fifth year of the duration of marriage, the differences are small until the age of 40 is reached, when the computed result becomes markedly greater than the actual.

The relatively large differences for the various age-groups characterising the second year of the duration of marriage are due to the fact that the length of the period, which must necessarily intervene between a first and second birth, does not admit of so wide a "scatter" of the cases of maternity as to make the result uniform; thus the average for the second year is in defect. This consequence is one which will (and does) tend to vanish for longer durations of marriage, owing to the fact that any want of coincidence of the intervals between birth and birth must more markedly characterise the points of time in proportion to their remoteness from the first year of duration of marriage. Owing to the fact that the period of

gestation alone is three-fourths of a year, and the period of lactation a considerable part of a year, and to the fact that so great a proportion of births appear in this year, it follows that the second year of duration must necessarily disclose a falling off in the apparent average. As time goes on, however, this apparent defect will tend to disappear, as will be clearly seen by a reference to Fig. 75, p. 268.

The character of the curves at their terminals for the longer durations may be fairly well ascertained by combining the terminal values. This has been effected as follows:—In the series shewn on Fig. 75 the two differences between the three last averages of the issue of curve for under 20, are taken, and similarly the four differences between the five last averages of the issue, etc., the number of values (averages of issue) being respectively 3, 5, 8, 9, 10, 12, and 12. The means of the differences, the numbers of which are respectively 7, 7, 6, 6, 5, 5, 5, 4, 2, 2, are taken, the results being as follows:—+0.230, +0.285, +0.582, +0.106, +0.153, -0.105, -0.162, +0.060, -0.246, +0.845, -0.489. The accumulated results compared with the successive multiples of 0.3643 furnish the co-ordinates of the average terminal shape. This gives:—

0	.364 .230	.729 .515	1.093 1.097	$1.457 \\ 1.203$	1.822 1.356	2.186 1.251	2.550 1.089	2,914 1,149	3.279 .903	3.643 1.748	4.007 1.259
Diff.	.134	.214	004	.254	.466	.935	1.461	1.765	2.376	1.895	2.748
Smth'd	.025	.100	.225	.400	.625	.900	1.225	1.600	2.025	2.500	3.025

The differences show the amounts by which the successive points fall short of the line defined by the formula (523). As is shown by the smoothed values, the defect from the linear condition, once it initiates, increases, on the average, very approximately as the square of the duration from the initiating point onward. This average defect  $\eta$  is expressed by the equation:—

$$(525)....\eta = 0.025 I^2$$

I denoting the duration reckoned from the initiating point. This point may approximately be found as follows:—

Average age at birth Initiation of droop†		22.9 10.0	27.5 15.0	32.4 18.0	37.3 24.0	41.9 29.0	46.3 33.?	
Difference	12.9	12,9	12.5	14.4	13.3	12,9	13.3	Aver. 13.1

<sup>\*</sup> i.e., Age of mother at birth of children. † Years of duration of marriage.

In these results the first line gives the average age of women at the time of maternity, and the second line gives the points where the droop from the linear relationship commences: the positions of these points being estimated from the graphs, Fig. 75, p. 268. The differences give a sensibly constant age, which is seen to average 13.16, hence the droop implies that the fecundity of those who are characterised by early marriage and late motherhood is less than the average for those who may be regarded as falling into the normal place.

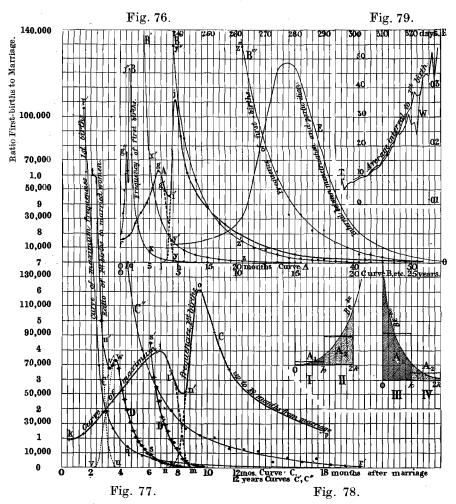


Fig. 17.

Fig. 176.—Curve A denotes the frequency, according to duration of monthly-groups, of first-births, viz., the number of cases in a total of 1,000,000 first-births for all durations of marriage (see Table LXXVII., pp. 252-3). The curve f, g, g', h, denotes the relative numbers attributable to prenuptial insemination, and the curve i, i', and j, etc., the relative numbers attributable to post-nuptial insemination. Curve B denotes the frequency, according to duration, of yearly groups, with a less extended lateral scale, the point g'' thereon corresponding to g on Curve A. Curves B', B'' and B''' are plotted on a larger vertical scale, y' and y'' being the same point as y, and z' and z'' the same point as z.

Curve E is the curve of relative frequency of birth, according to the interval after the last menstruation, see Table LXXXIX., p. 278.

Fig. 77.—Curve C shews the relative maximum frequencies according to age (i.e., for any age). The points l, l' and m, and n, n', o and p have the same significance as points g, g' and h, and i, i' and j in Fig. 76, curve A, and the point k corresponds to f.

to f.
Curves C', C", are an extension of curve C, the lateral scale being altered. The point p' is the same as p, q' as q, etc.
Curve D denotes the ratio, according to age, of first-births, to married women. It appears to be compounded of two curves, viz., u, u' and v, v', w, s. Curve D' is plotted on a larger scale, the point s' being identical with s.

Fig. 78 illustrates the formulæ for determining the exponential curves so as to make the shaded areas equal to the areas of the rectangles A<sub>1</sub> and A<sub>2</sub>, in order to determine the positions of the centroid verticals, etc. See formulæ (496) to (510), pp. 264-5. pp. 264-5

Fig. 79 is the graph of the approximate average intervals to between marriage and the "unprejudiced" first-births for New South Wales, 1893-1898, and for the Commonwealth, 1908-1914; the light zig-zag line marked W denoting the result for the former, and the heavy zig-zag line marked T denoting that for the latter. The figures denote months, and the lateral divisions denote two years' duration.

- 36. The polygenesic, fecundity, and gamogenesic distributions.—As we have seen, there are two ways in which records of *issue*, according to age and duration of marriage, come to hand, viz.:—
  - (i.) When, at the registration of births, the age, duration of marriage, and "previous issue" are also registered; and
  - (ii.) When, at a Census, the age, duration of marriage, and total issue are ascertained.

There are certain differences between these. In (i.) the total age-range covered is that of the child-bearing period only; in (ii.) the age-range is from the earliest age of maternity to the end of life. In (i.) the cases come under observation during a period of time; in (ii.) they come under observation at a given moment. Hence, to deduce (ii.) from (i.) it is essential that the necessary records of births, migration, and deaths should extend over a long period of time, and even then, the deduction of (ii.) from (i.) is by no means simple. Both records are, however, of value statistically and both yield appropriate measures of fecundity, though on the other hand both require corrections if they are to represent what would have been furnished by a "constant population."

If, on a plane, the ages of mothers (x) be plotted as abscissae, and their duration of marriage (y) be plotted as ordinates, and if then verticals to this xy-surface be drawn denoting the number of cases of maternity, corresponding to each age and duration, the surface so defined may be called the genesic distribution at maternity, or simply (i.) the polygenesic distribution. Similarly if the verticals denote the number of children recorded at any moment as having been borne by women of any age and duration of marriage, the distribution may be called the general genesic distribution, or (ii.) the fecundity distribution. The fecundity-distribution-contours, or lines denoting equal issue for various ages and durations of marriage, can be drawn by means of formula (523), together with the values of the constants given in Table XCI., the values of the durations (according to age) where the linear condition ends, see § 35, and formula (525). If 11 be assumed to be the earliest age of what may be called "extraordinary marriage," and 14 be assumed to be the earliest age of "ordinary marriage," and if also the generally approximate result, be adopted, viz., 0.6667 + 0.3643i, the plan of the polygenesic surface will have for a limiting boundary the line y = x - 11; its surface will, for the major part, be (approximately) a plane, steepest at right angles to the axis of abscissæ (age), and making an angle  $\theta$  with the xy plane, the tangent of which angle is 0.3643. For any age x, the line on the surface denoting increasing durations of marriage,

<sup>&</sup>lt;sup>1</sup> The assigning of the word "polygenesic" to the one, and "fecundity" to the other distribution, is, of course, somewhat arbitrary: the terms might, of course, have been interchanged.

rises uniformly till it attains the value y = x - 14. For greater durations than this the surface will droop. Between the axis and the contourline representing say the third or fourth child, the surface is somewhat irregular.

If the distribution is based on the ages at marriage and the duration of marriage, it may appropriately be called the gamogenesic distribution. The abscissæ then are the ages of mothers when married (i.e., "ages at marriage"), and the ordinates, as before, are the duration of marriage.

37. Diminution of average issue by recent maternity.—Returning to the results shewn in Tables XC and XCI., for the second and subsequent years of duration of marriage, it may be noted that they are important in any attempt to ascertain what may be called the *unmodified fertility-ratio*. When the fertility-ratio is found by merely dividing the total number of cases of nuptial maternity at any age by the number of married women at the same age, the quotient is "modified" by the fact that they are not all at equal risk. If the fertility-ratio is to shew what is due to change of age alone, or rather, to change of age, unmodified by the effect of a recent birth, but unaffected as to all other factors, a certain proportion of the married women should be subtracted from the total. We shall first consider the question of estimating the diminution of average issue by recent cases of maternity.

Formula (523), shewing the general rate of increase in the average issue, (since it is derived only from all cases of maternity coming under observation for each duration), gives what may be called "the unmodified rate of increase" for what also may be called "the fertile section only" of the whole body of married women; see § 34, hereinbefore. Consequently the differences of average issue for successive durations of marriage, although an indication of, do not give a very exact measure of the proportions of women who are virtually removed from risk. These proportions are doubtless better defined by the differences between the observed average and the average issue computed upon the assumption of constant average rate of increase per year of duration. Hence the ratio of the diminution in the cases of maternity for any given age-group and for any given duration of marriage may at least approximately be found as follows:—

Let c'' be the average number of children (or average issue) on the supposition of a uniform increase, and c the actual number, each with suffixes to denote the duration of marriage and age. Then the diminution-ratio, that is the amount by which any previous births will have diminished the actual record of cases, will presumably be c/c''. But this diminution-ratio applies only to the cases in which maternity has occurred.

Consequently if the values of this fraction be formed, for successive years of duration, commencing not from marriage, but from the number for the first year of duration of marriage, it will furnish a rough estimate of the correction necessary, if it be desired to ascertain, from the number of cases actually occurring, the number of cases that would have occurred had the whole of the women in any age-group been at full average risk.

If to the values of c'', for duration 0 to 1, given in the top line of Table XC., successive multiples of 0.3643 be added, and the sums, so formed, be subtracted from the values on the second, third, etc., lines of that table, we shall obtain the figures shewn on Table XCIII. on next page. These figures afford a fairly good indication of a systematic effect, according to duration, that is, of an effect which varies with age. This variation is not the same for each duration, and appears to change somewhat irregularly with age. The mean of the changes gives a fairly regular curve (see the upper part of Table XCIII.).1 The individual graphs for the various durations, however, appeared to show that the adoption of this general average for each series, was of doubtful validity, and for this reason a different linear change according to age was adopted for each duration.

In any attempt to estimate the diminution of the numbers at risk by means of the falling off in the average issue, according to duration, it is probably desirable to take the adjusted results in the upper part of Table XCIII. This will give -.186/.364, +.177/.729, etc., for age 18.92, -.217/.364, +.177/.364, etc., for age 22.87; and so on. The results are shewn in Table XCIV. If we call the tabular value c'', the ratio  $\rho$  of the altered risk to the average risk is given by :-

$$(526).....\rho = 1 + c''' / 0.3643 = 2.745 (0.3643 + c''').$$

The value of  $1-\rho$  will be required; it is consequently:—

$$(527)....1 - \rho = -2.745 c'''.$$

Since c''' is negative, if for any duration of marriage fewer women than the average have given birth to children (owing to a recent birth, etc). then this last expression is positive. Table XCIII. shews the deviations, according to age and durations of marriage up to four years; from the general rate of increase.

<sup>&</sup>lt;sup>1</sup> The curve can be very closely represented by the curve  $a+bx+cx^{n}$ , where is greater than 1. Smoothed, the values would be about +.000, -.031, -.124, -.183, -.265, -.422.

TABLE XCIII.—Shewing the Average Effect of a recent Maternity upon the Average Issue (Number of Children) Corresponding to Various Durations of Marriage, and of a Consequent Correction.

Mothers		xcess (- Avera	+) or De age (Line	efect () ear) Incre	in the A	verage N rding to	(umber o Duration	f Childre of Marr	en, on an lage.			Valu	es of 1		
1				D	uration	of Marri	iage.					varu	-2.745	c'''	
Age-		Crı	ıde Resi	ılts.			Adju	sted Res	ults.						
group. Years.	*1-2.	2–3.	3-4.	4-5.	Mean.	†1–2.	2-3.	3-4.	4-5.	Aver- age Age.	Moth- ers' Age.	k = 1	k=2.	k=3.	k=4.
-19 20-24 25-29 30-34 35-39 40-44 45-	120 .217 .295 .307 .326 .280 355	+ .190 .143 .022 059 .153 .304 326	+.046 .068 022 .084 .147 .199	007 .210 +.047 046 .107 .279	+.027 054 .062 .124 .183 .265	186 .217 .252 .292 .328 .363	+.177 .106 .023 070 .154 .237	+.078 $.031$ $024$ $.086$ $.141$ $.197$	+.049 014 .086 .168 .241	18.92 22.87 27.46 32.65 37.29 41.91	12 13 14 15 16	+.364 .385 .407 .428 .449	777 .728 .679 .629	 376 .343 .310	 304
40-	555	320	449	-,558	.422	396	315	249	382	46.29	17 18	.470 .491	.531		.218 .174
Aver.	Differen	ce for an	age-diffe	erence of	10 yrs.	077	179	120	158		19 20	.512 .534	.482 .433		.13
Mothers		Ave	rage Inc	rease in	the Ave	erage Nu	ımber oi	Childre	n.	·	21 22	.555 .576	.384 .335		.04
Age- group.		Cruc	le Resul	ts.‡			Adjusted	Results	-§	Age.	23 24	.597 .618	.286 .236		
19- 20-24 25-29 30-34	.244 .147 .069 .057	.7	75 25 62	.220 .289 .340 .339	.321 .451 .433 .402	.245 .147 .088 .053	.690 .680 .650	.240 .275 .310 .345	.453 .446 .429 .402	17.5 22.5 27.5 32.5	25 30 35	.639 .745 .850	187 + .059 .304	+ .151 .316	.129 .340 .563
35-39 40-44 -45	.030 .084 .009	.5	38 41 94	.370 .469	.404 .284 .255	.032 .019 .011	.530 .440 .330	.380 .415 .450	.365 .328 .271	37.5 42.5 47.5	40 45 50	0.956 $0.062$ $0.167$	.550 $.800$ $+1.041$	.480 .645 + .810	.786 $.997$ $+1.214$

The above table appears to show that the period of time over which the influence of a case of maternity extends on the average, follows no simple law, and is by no means negligible for some years, especially as regards the later portion of the child-bearing period. The whole method is not quite satisfactory, but is the best available, until the record of the procreative history of a large number of married women is to hand, giving the intervals between marriage and the births of successive children preferably compiled for intervals of single months from at least one to sixty, and for somewhat larger intervals (quarters, half-years, or years), to the end of the child-bearing period. Such statistics would reveal accurately the characteristic of the frequency of maternity according to duration of marriage, and would allow of the ratio  $\rho$  referred to in formulæ (528, 529) hereinafter being more exactly ascertained.<sup>1</sup>

<sup>\*</sup> These results are found by adding multiples of 0.3643 to the figures in the first row of Table XC., and then subtracting them from the figures for the corresponding duration in the successive columns. † These results are the linear smoothings of the crude results. The linear adjustments are made by using the "average" ages, and can be regarded only as fairly satisfactory. The total number of cases of maternity analysed is, however, large; viz., 805,015. ‡ These rows are the differences of the columns in Table XC. § The adjustments follow no general law: the first is on a curve  $Ae^{-bx}$ , the second is  $A' - Bx^2$ , the third, A'' + B'x, and the fourth  $A''' - B'x - Cx^2$ , the intervals  $x_2 - x_1$ , etc., between the age groups being taken as always of equal value, i.e., the adjusted values are for 17.5, 22.5, etc.

<sup>&</sup>lt;sup>1</sup> As far as I am aware such a statistic has not been compiled, although it is of considerable importance.

38. Crude fertility according to age corrected for preceding cases of maternity.—The ratio (m/M), between the number of nuptial mothers (m) of a given age-group during a given period of time, to the total number (M) of married women of the same age-group, is not the true monogenous-fertility-ratio, inasmuch as the M married women are not homogeneous as regards the maternity-risk  $(\rho)$  to which they are subject. Obviously m/M is too low a value for women whose fertility remains in abeyance, and is too high a value for women who have just borne children. The survivors after the lapse of k years of the married women of age x last birthday are  $L_{x+k}$  /  $L_x$ . Consequently if  $\rho_k$  is the average risk for the kth year after a birth (calling the year of birth 0), the corrected fertility ratio (p'') is given by the equation :—

$$\mathfrak{p}''_{x} = \frac{m_{x}}{M_{x} - \{m_{x-1} \cdot \frac{L_{x}}{L_{x-1}}(1-\rho_{1})(1-r_{x-1}) + m_{x-2} \cdot \frac{L_{x}}{L_{x-2}}(1-\rho_{2})(1-2r_{x-2} + \text{etc.}\}}$$

 $(1-kr_{x-k})$  denoting the rate at which the mothers of age x-k have increased in k years. This may perhaps be ordinarily taken as the same at all ages, and as the rate of the population increases. The above formula may be put in the following form, viz.:—

$$\mathfrak{p}'' = \frac{m_x}{M_x} \cdot \frac{1}{1 - \left| \frac{m_{x-1}}{M_x} \cdot \frac{L_x}{L_{x-1}} (1 - \rho_1)(1 - r_1) + \ldots + \frac{m_{x-k}}{M_x} \cdot \frac{L_x}{L_{x-k}} (1 - \rho_k)(1 - kr_k) + \ldots \right|}$$

and the ratios of the m/M quantities in the denominator do not need to be very exactly computed. It will always be abundantly accurate for the purpose in view to assume that:—

$$(530)....L_x/L_{x-k}=1-\tfrac{1}{2}k\;(q_x+q_{x-k})$$

a formula which is satisfactory through a fairly large range for  $k.^2$  Since the quantity between the braces in (529) is positive and small, its effect is to increase the value of  $\mathfrak{p}''$ . The correction is important in any attempt to ascertain the age of greatest fertility, consequently the values given in Table LXXIII., p. 242, are those with which we are mainly concerned; see columns ix. and xv. therein. The values of the factors  $(\kappa)$  of m/M in the denominator of (529) can be readily tabulated for say r=0.01 and 0.03.

 $<sup>^1</sup>$   $L_x$  denoting the mean population living in the year of age x: as in the ordinary actuarial notation.

<sup>&</sup>lt;sup>2</sup> For example from Australian Life Tables for 1901-1910, Report of Census, Vol. III., pp. 1217-8, we have for ages 40 and 30, from the L values 0.93986, and from the q values 0.93815, *i.e.*, for so large a value of k as 10, the error is less than 0.002.

The value of the L,  $\rho$  and r terms are as follows for Australia:—

TABLE XCIV.—Shewing the Factors Required to Correct the "Crude Fertility-ratio," for Preceding Cases of Maternity. Australia, 1908-1914.

	Valu	es of (1—	$kr) L_x/L_x$	:- k	Values of $\kappa$ when $r = .01$ .						
Age of Mother,	9	• = .01*;	k = 1  to  4.		r = .01  and  .03; $k = 1  to  4$ .						
	1.	2.	3.	4.	1.	2.	3.	4.			
15	.9879	.9761	.9643	.9527	$^{+.423}_{.414}$	662 .635	331 .311	29			
20	.9868	.9739	.9613	.9590	+ .527	422	171	08			
25	.9858	.9720	.9584	.9450	+.630	.405 182	.160 013	+.12			
30	.9849	.9701	.9556	.9414	$\begin{array}{c} .617 \\ + .733 \end{array}$	+.057	$^{.012}_{+.144}$	+.32			
35	.9840	.9683	.9529	.9378	+.837	055 + .294	$^{.135}_{+.301}$	$^{.29}_{+.52}$			
40	.9830	.9663	.9500	.9340	$^{.820}_{+.940}$	+.531	$^{.282}_{+.456}$	$^{.48}$			
45	.9821	.9645	.9472	.9304	$^{921}_{\substack{+1.043\\1.022}}$	.509 +.767 .736	$^{.428}_{+.611}$ $^{.573}$	$\begin{array}{c} .66^{\circ} \\ + .92^{\circ} \\85^{\circ} \end{array}$			

<sup>\*</sup> To find the values for any other value, r' say, of r, multiply the tabular values by (r'-r)/r. † To find the values for any other value of r, multiply by (1-rk)/(1-.01k). Thus, for r=.02 the multipliers of the successive columns are 0.9899, 0.9796, 0.9691, 0.9583; and if r=.03 the successive multipliers are 0.9797, 0.9592, 0.9381, 0.9167.

The above values are very approximately given by:-

$$(531).....(1-kr) L_x/L_{x-k} = 1 - 0.000188k (47.7 + x);^{1}$$

and those for the correcting factors  $\epsilon$  by :—

(532) .... 
$$\epsilon_1 = 0.02070 (x + 5.43)$$
; (532a) ....  $\epsilon_2 = 0.04763 (x - 28.91)$ ; (532b) ....  $\epsilon_3 = 0.03140 (x - 25.54)$ ; (532c) ....  $\epsilon_4 = 0.04057 (x - 22.15)$ .

Formula (525) may thus be written:—

$$(533)\ldots \mathfrak{p}'' = \frac{m_x}{M_x} \cdot \frac{1}{1 - \frac{1}{M_x} \left(\kappa_2 m_{x-1} + \ldots + \kappa_k m_{x-k}\right)}$$

k being the tabular value given in Table XCIV. (in which r=.01 and r=.03), and the probability of maternity ascertained by this last formula, will be free from the effect of recent cases of maternity: that is the crude probability must be multiplied by the fraction following m/M.

39. Age of greatest fertility.—When the probabilities according to age of maternity have been corrected so as to represent what would be given if all women were at equal risk, then the age of greatest probability may be regarded as the age of greatest fertility. Applying formula (533) to the data in Table LXXIII., p. 242, we have the following results about the maximum:—

<sup>&</sup>lt;sup>1</sup> More exactly the values of the constant to be added to x are 47.60, 46.81, 47.63, and 48.63, and of the coefficients to be multiplied into k are 0.0001933, 0.0003866, 0.0005700, and 0.0007433.

TABLE XCV.—Shewing Corrections to the Fertility-ratio for Ages 13 to 23, when Allowance is made for Preceding Cases of Maternity.

Age of	Val	ues of Kw	hen k = 1	to 4.		$\mathfrak{p} = \mathfrak{p}''$	Fertility-ratio.		
Mothers.	1.	2.	3.	4.	Crude.	Smoothed.	Crude.	Corrected.	
13 14 15 16 17 18 19 20 21 22 23	+.374 .394 .414 .434 .455 .475 .495 .516 .536 .556 +.577	727 .681 .635 .589 .543 .497 .451 .405 .359 .313	371 .341 .311 .281 .251 .221 .191 .100 .130 .100 070	342 .304 .266 .288 .190 .152 .114 .077 .039 001 +.037	1.039 1.011 1.013 1.012 1.048 1.066 1.077 1.092 1.074 1.106 1.123	1.001 1.013 1.024 1.036 1.048 1.059 1.071 1.083 1.094 1.106 1.117	.5? .2055 .2269 .4063 .4316 .4776 .5022 .4540 .4375 .4157	.52? .2076 .2299 .4112 .4521 .5093 .5409 .4956 .4700 .4596 .4283	

Although the values of  $\kappa$  are of the same order of magnitude, yet within the range shewn, the values of the successive  $\kappa m$ -terms rapidly diminish, so that although there is no theoretical justification for stopping at k=4, the inclusion of later terms would but slightly affect the result (at least in the second place decimals).

The factors K shew that about the age of maximum fertility the correcting factors to give the fertility, unprejudiced by previous cases of maternity, increase linearly with age, and are represented very approximately by the formula:—

$$(534)...K = 1 + 0.01163 (x - 12.91).$$

The values for these factors, so computed, are the smoothed values in the preceding table.

A smoothing, independent of that already given in Table LXXXIII., gave, as the maximum for the uncorrected fertility-ratio, 0.483; and a similar smoothing of the corrected values gave 0.517, the maxima and corresponding ages being:—

Uncorrected, age, 18.8, 10.483; corrected, age, 19.0, 0.517.2

In the method outlined, of correcting the crude fertility-ratio (probability of maternity), equal "weight" is attributed to the values of k. An examination of Fig. 75 shews, however, that the "weight" to be attributed should probably decrease with increase in the value of k (that is with the number of years elapsed since a previous birth). Moreover, the change in the numbers of married women and cases of maternity is so rapid at the ages of maximum fertility that the age divisions should be less than one year, and the ages need to be very exactly given, which unfortunately they are not. For these reasons great exactitude in regard to the correction is at present impracticable.

40. Fecundity-correction for infantile mortality.—The frequencies of child-bearing as between two populations are, like their birth-rates, rigorously comparable as accurate measures of fecundity, only when their infantile mortality-rates are identical, and the crude frequencies require,

<sup>&</sup>lt;sup>1</sup> The result in Table LXXXIII. was 18.23 years.

<sup>&</sup>lt;sup>2</sup> The factor, according to (534) above, gives, on multiplying into, 0.483, 0.5168.

therefore, a correction, to reduce the risk of maternity to an equality; see Part XI., §§ 4-6, pp. 145-152. It has been shewn that the infantile mortality correction to birth-rate is, on the whole, about  $\beta_0 = \beta$  (1+0.033 $\mu$ ); see p. 145. If, therefore, there were two equal populations of say married females (M), of equal fecundity (f), but with different rates of infantile mortality, we should have for the cases of maternity (m) occurring therein, respectively:—

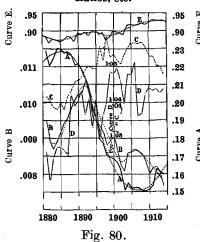
$$(535). \dots m_1 = fM \ (1 + k_1\mu_1), \text{ and } m_2 = fM \ (1 + k_2\mu_2) ;$$
 whence it follows that

$$(536).....f = \frac{m_1}{M(1+k_1\mu_1)} = \frac{m_2}{M(1+k_2\mu_2)}$$

Thus the correction is always very small, and, in general, is practically negligible.

41. Secular trend of reproductivity.—The crude reproductivity may be measured by the ratio of the number of confinements to the number of

Nuptial and Ex-nuptial Maternity-Ratios, etc.



Curve A is the ratio of nuptial confinements to all married women.

Curve B is the ratio of ex-nuptial confinements to "unmarried" women of 12 years of age and upwards.

Curve C is the ratio of the exnuptial to the nuptial confinement rates, the range being between .038 and .059.

Curve D shows the variation in the average number at a birth.

Curve E shews the variations in the survival factor for the first year of life.

persons at uniform risk; thus the crude nuptial reproductivity is the ratio of nuptial confinements to the total number of married women, and similarly, the crude ex-nuptial reproductivity is the ratio of exnuptial confinements to the total "unmarried," which here will include "divorced  $_{
m the}$ and " widowed." The ratios "crude," since no corrections have been applied for age-differences in the female population, and it is obvious from columns ix., x., xv., and xvi. of Table LXXIII... p. 242, that fertility greatly varies with age. For this reason, whenever the age-distribution is not identical, the results are not strictly comparable: they do not rigorously measure the degrees of reproductivity, or of malthusianism, operating. sequently, for strict comparisons, a properly determined index of initial reproductivity would have to be computed, see §§ 3 to 6, pp. 235-239.

Neglecting this, however, for the present, and restricting the consideration to the crude initial nuptial

<sup>&</sup>lt;sup>1</sup> It may be noted that after deducting the period of gestation and the puerperal period, there remains about one-sixth of a year during which mothers of the first-sixth of any year of record may give birth to a second child even in the same year, and the chance of this occurring is increased by the death of the child born.

and ex-nuptial reproductivities, the results are set out in Table XCVI. hereunder; see columns (ii.), (iii.), and (v.) thereof. The results are shewn also by curves A and B of Fig. 80, the former curve denoting the nuptial, and the latter the ex-nuptial frequency of maternity. The figure shews that while the nuptial and ex-nuptial rates by no means run identically, they yet exhibit, on the whole, similarity of trend, the ex-nuptial rate being roughly 0.05 of the nuptial. The exact fluctuations of the ratio of the ex-nuptial to the nuptial rate are indicated in column (v.) of Table XCVI., and are shewn as curve C in Fig. 80. The dotted lines on curves A and B shew the general trend of the phenomena.

TABLE XCVI.—Shewing the Secular Changes of Nuptial and Ex-nuptial Reproductivity. Australia, 1881 to 1914.

					<del></del>		
Year,		Ratio of Nuptial Confine-	Ratio of Ex-nuptial Confine- ments to	Ratio of Births_to	Ratio of Ex-nuptial to	Infantile Mortality (Ratio of Deaths of	Survival Coefficients
1681.		ments to Married Women.*	Number of Unmarried	Total Con- finements.	Nuptial Rates.	Children during first	for end of First Year
(i.)		(ii.)	Women.† (iii.)	(iv.)	(v.)	12 Months)‡ (vi.)	(vii.)
1881		.2285	.00950	1.00865	.0416	.1165	.8835
1882	.:	.2206	.00891	1.00779	.0404	.1357	.8643
1883		.2245	.00870	1.00847	.0388	.1222	.8778
1884		.2305	.00893	1.00875	.0380	.1260	.8740
Mean 1-4	••	.2269	.00901	1.00842	.0397	.1251	.8749
885	• •	.2301	.00918	1.00873	.0399	1292	.8708
000	• •	2274	.00946	1.00866	.0381	.1271	.8729
00=	• •	.2285	.00957	1.00852	.0419	.1164	.8836
1000	••	.2271	.00983	1.01021	.0433	.1164	.8836
1889	• •	2206	.01008	1.00989	.0457	.1319	.8681
Mean 5-9	• •	.2267	.00962	1.00920	.0418	,1242	.8758
1000	• •	2216	.01021	1.01005	.0461	1082	.8918
004	• •	.2181	.01026	1.01030	.0470	.1155	.8845
1000	• •	.2133	.01060	1.00865	.0497	.1058	.8942
1000	• •	.2072	.01034	1.01008	.0499	.1149	.8851
1004	• •	.1947	.00961	1.00931	.0494	,1031	.8969
1894 Mean 0-4	••	.2110	.01020	1.00968	.0484	.1115	.8885
1005	. • •	.1916	.00947	1.01008	.0494	.1012	.8988
000	••	.1788	.00947	1.00900	.0558	.1126	
100=	••	.1770	.00935	1.01066	.0517	.1048	.8874 .8952
1000	••	.1700	.00879	1.00997	.0586	.1272	.8728
1898 1899	• •	.1697	.00894	1.01086	.0527	.1167	.8833
Mean 5-9	• •	.1774	.00894	1.01030	.0536	.1125	.8875
1000	•••	.1691	.00905	1.01078	.0535	.1002	.8998
1001	• •	.1668	.00865	1.01078	.0519	.1037	.0990
	• •	.1625		1.01095		.1037	.8963
1902 1903	• • •	.1513	.00826 .00807	1.00997	.0508 .0533	.1105	.8929
1004	• •	.1554		1.01079			.8895
1904	• •		.00859		.0553	.0825	.9175
Mean 0-4	1	.1610	.00852	1.01062	.0530	.1008	.8992
1905	• • •	.1524	.00861	1.01076	.0565	.0819	.9181
1906		.1527	.00868	1.01112	.0568	.0836	.9164
1907	• •	.1527	.00864	1.00962	.0566	.0814	.9186
1908	• • •	.1506	.00857	1.00969	.0569	.0780	.9220
1909	• • •	.1506	.00837	1.01024	.0556	.0718	.9282
Mean 5-9	• • •	.1518	.00857	1.01029	.0565	.0793	.9207
1910	• •	.1511	.00801	1.01040	.0530	.0751	.9249
1911	٠.	.1541	.00818	1.01033	.0531	.0680	.9320
1912	٠.	.1632	.00821	1.01037	.0503	.0708	.9292
1913		.1609	.00805	1.01025	.0500	.0720	.9280
1914		.1598	.00766	1.01038	.0479	.0713	.9287
Mean 0-4		.1578	.00802	1.01035	.0509	.0714	.9286

<sup>\*</sup> That is, to all married women, irrespective of age.
† That is, to "never-married," "widowed," and "divorced," of 12 years of age and upwards, taken together.

That is, to "never-married," "windowed," and "divorced," of 12 years of age and upwards, taken together.

The infantile mortality as given is not the ratio of deaths registered as under one year of age, in any year, to the births registered in the same year, but are those given in a paper "On the improvement in infantile mortality, etc.," read before the Australasian Medical Congress in September, 1911 (see p. 872 Journ.), and are related to the number of births of the "equivalent year."

<sup>42.</sup> Crude and corrected reproductivity.—It has been shewn in Part XI., § 6, see Table XXXV., that the crude birth-rate gives only the *initial* reproductivity, and that, owing to the measure of infantile

mortality, the residual, after the first 12 months have elapsed, is more significant than the birth-rate as regards the increase of the population. The necessary correction is secured by multiplying by a "survival factor." The principle may be extended for various purposes. Thus survival factors  $(\sigma)$  may be calculated for the commencing school-age, the ages of puberty or nubility, the commencing age of military service, the age of highest average economic efficiency, and so on. In actuarial notation these factors are denoted by  $l_x/l_0$ , and for brevity's sake may be denoted by  $\sigma_x$ . To compare two populations for survivals, S, up to any age x, we have, therefore, B denoting the births:—

$$(537)....S_x = Bl_x/l_0 = B\sigma_x = B - D_x$$

in which  $D_x$  denotes the aggregate of the deaths (of the native-born) up to age x. When x=1, the values of  $\sigma$  are unity, less the rate of infantile mortality taken for the "equivalent year." For rates, these quantities must be divided by the mean population of the period covered by the births. The more rigorous treatment of this question has already been dealt with in Part XI., §§ 7 to 9, pp. 152-180; see also Tables XXXVI. and XXXVII. The infantile mortality varies, however, considerably from year to year, see column (vi.) in Table XCVI., which gives the rates calculated approximately for the "equivalent year." If  $\gamma$  denote the infantile mortality (see p. 151, hereinbefore),  $\sigma$  being the survival factor, then we have:—

$$(538)...\sigma = 1 - \gamma$$
; or  $\gamma = 1 - \sigma$ ;

as on (352), p. 151. This, of course, differs according to sex, with time, as is shewn in Table XCVI., and according to locality. The highest value of the survival-factor for Australia was 0.9320 in 1911. For the period 1901-10 for the Commonwealth of Australia it was 0.90490 for males, and 0.92047 for females, 2 corresponding to infantile mortalities of 0.09510 and 0.07953. We thus arrive at the conception of a survival-value for a birth-rate, that is, the birth-rate reduced to its value at age x, and this survival-value may be averaged for the whole of life, i.e., integrated for all ages. Such an integral will constitute the best general measure of the reproductivity. It is equal to the average period lived multiplied by the birth-rate. Or if  $\omega$  denote the greatest possible age, then:—

$$(539) \ldots \Sigma_0 = \beta \int_0^\omega dx$$

and  $\Sigma_0$  is the reproductivity of the population taken as a whole. If  $\sigma_0$  be unity, and the unit of x be one year, then the value of (538) will be the

<sup>2</sup> See Life Tables, Census Report, Vol. III., pp. 1215 and 1217.

 $<sup>^1\</sup> Vide$  a paper (by the author): "The improvement in infantile mortality; its annual fluctuations and frequency according to age, in Australia." Journ. Australasian Medical Congress, Sydney, Sept. 1911, pp.670-679.

birth-rate multiplied into the number of years expressing the length of life lived on the average; consequently the product of the birth-rate into the "expectation of life at age 0," may be taken as the most service-able expression of the reproductivity.

The value given by (538) may be regarded as the crude reproductivity. The birth-rate  $\beta$  is ordinarily computed as for the total population, but may also be based upon the total female population, upon the female population of child-bearing ages, or upon the married of child-bearing ages plus a reduced number of the unmarried, equating them to the nuptial condition. Let the ratio of the fertility of women at full risk (or otherwise if desired), at any age x, to the fertility at the age at which it is a maximum be denoted by  $f_x$ : then the actual number of married women of all ages may be reduced to an equivalent number of women at the age of maximum fertility by multiplying by this quantity. With these can be included also the unmarried, with whom in Australia the fertility is about one-twentieth of that of the married. The corrected reproductivity may be given in the form of a birth-rate, viz.,  $\beta_{\epsilon}$ :—

$$(540)....\beta_e = B / \Sigma (f_x M_x + f_x' U_x)$$

in which  $\Sigma$  denotes "sum," f and f' are the ratios for the fertilities of the married and unmarried respectively, referred to the greatest fertility of the married, and M and U are respectively the numbers of the married and the unmarried, who together give birth to B children. This measures the ratio of the actual births to a fictitious number of mothers of highest fertility, and hence birth-rates so computed shew the variations of the extent to which potential fertility is actualised. These, of course, may be further reduced to their survival values.

The mode of comparing reproductive efficiency by means of an index, viz., the genetic index or first natality index, has already been indicated; see § 5, p. 237, hereinbefore.

43. Progressive changes in the survival coefficients.—The survival-factors are by no means constant, as is shewn in column vii. of Table XCVI. As tabulated, they are merely unity, less the ratio of the deaths under 12 months to the births in the same year. This, as shewn before,

$$\stackrel{\bullet}{e}_x = \mathbf{T}_x / l_x = \int_x^{\omega} dx \div l_x$$

when x=0, may, when multiplied by the birth-rate, be adopted as the measure of the reproductivity of a population. Since this is obtained from the mortalities at successive ages, it is not quite homogeneous, as it is affected by the vitality of migrants, and, moreover, the mortality of the older part of the population is affected by their earlier history, and may not therefore represent future experience. If

$$l_0 = 1$$
, then  $\stackrel{\circ}{e_0} = \mathbf{T_0} = \Sigma_0 / \beta$ .

Actuarially, the quantity:-

is not quite correct, see pp. 155-160, but the correction is of no moment for the present purpose. It is worthy of note that the infantile mortality is roughly about 0.5522 of the rate of confinements of married women, as is shewn by comparing the means. The means (see Table XCVI.) 0.2269, 0.2267, etc., multiplied by the above fraction gives the following results:—

Period	1881-4	1885-9	1890-4	1895-9	1900-4	1905-9	1910-4
Infantile mortality As computed from the	.1251	.1242	.1115	.1125	.1008	.0793	.0714
nuptial confinement rate Survival factor divided by		.1252	.1165	.0980	.0889	.0838	.0871
ratio of nuptial confinements	.5513	.5479	.5284	.6342	.6261	.5224	.4525

The ratio is therefore not uniformly constant.

The infantile mortality is decreasing, but nevertheless shews a fairly definite fluctuation, see curve E, Fig. 80, which shews it on a large vertical scale; its limiting value is, of course, unity.

## XIV.—COMPLEX ELEMENTS OF FERTILITY AND FECUNDITY.

1. General.—In dealing with the more complex elements of fertility and fecundity, it will generally be necessary to distinguish between the nuptial and ex-nuptial cases, and since their frequency is very different, some simple method of correlating and comparing the two will have to be devised.

Often it is necessary to distribute unspecified cases, since, in double-entry tabulations, the cases are often *partially* specified, and the neglect of partially-specified and wholly-unspecified cases will often lead to material error.

There is another general matter of importance, viz., the corrections required in statistics of duration, if they are required to represent the results which, other things being equal, would have been furnished by a constant population. This will receive attention in § 3, pp. 298-9.

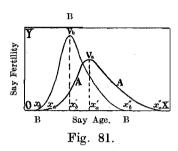
2. Correspondence and correlation.—It is often possible to see the essential identity of two curves by mere change of scale, or by systematic deformations (anamorphosis) of one in order to bring it into agreement with another. This fact is of value in the graphs of various vital phenomena.

For example, any attempt to make the widest possible comparisons of population phenomena requires the construction of world-norms for the human race. But such an attempt involves the consideration of physiological and general correspondence of human developments. In connection with marriage, fertility, fecundity, etc., and their significance, for instance, this demands the consideration of the following, viz.:—

- (a) The average ages of puberty, nubility, etc.
- (b) The frequency-distribution about those ages;
- (c) The fertility and fecundity at different ages;
- (d) The characteristics of the decay of fecundity at the end of the fertile period.

<sup>&</sup>lt;sup>1</sup> The determination of a type-formulæ to be adopted for any two curves, the ascertaining of their constants, and of the "skewness" of each curve will serve to exhibit their degree of correlation. This can also be expressed by a correlation coefficient; see "Statistical Methods," by C. B. Davenport, 1904, and the monographs of Prof. Karl Pearson, W. F. Sheppard, G. U. Yule, De Vries, W. Palin Elderton, Gini, Savorgnan, and others.

Suppose, for example, curve A, Fig. 81, represents the average fertility according to age of women of one part of the world and B that of another part. Let x, x', x'', etc., denote the abscissa of the initial



point, that of the mode, and that of the terminal point of the curve A, or of curve B, the particular curve being indicated by the suffix a or b. Then the simplest correspondences are those where  $x_a/x_b = x'_a/x'_b = x''_a/x'_b$ , etc., or where  $x_b - x_a = x'_b - x'_a = \text{etc.}$ , i.e., where the abscissæ of the corresponding critical points of the curves are in a constant ratio, and the ordinates are also in a constant ratio, or where the abscissæ of the critical points differ by a constant. Correspondence of this

character may be called *planar*, because the curve B can be derived from the curve A by parallel linear projection on to a plane inclined to that on which A lies. If the two curves in question be represented by  $y_a = F_a(x)$ ;  $y_b = F_b(x)$  then planar correspondence may be defined as follows:—

The points on curve B are in  $planar\ correspondence$  with those on A when—

$$(541)....y_b = k F_a (mx_a + q)$$

k, m, and q being constants: when k or m or both are functions of  $x_a$ , then the correspondence is non-planar. If these functions of  $x_a$  are not simple, the correspondence becomes less significant.

This method of envisaging the problem has advantages over the system of determining a mere numerical "coefficient of correlation," because it is often possible to construct one curve from the data of the other. Moreover, it is not without value to examine how far the graphs of phenomena, which might have been imagined a priori to be identical, or convertible by oblique projection with change of scale, differ. Later nuptial and ex-nuptial fertility, according to age, will be compared.

3. Corrections necessary in statistics involving the element of duration.—The type of corrections necessary to be applied to the data of statistics involving the element of duration, depends upon the purpose in view. Two types are of special importance, that which aims at presenting the results, in the form in which they would have been given by (a) a constant population, and (b) by a population increasing according to some definite law, which for general comparative purposes is preferably

<sup>&</sup>lt;sup>1</sup> See Galton's graphic method, F. Galton, 1888, Proc. Roy. Soc. Lond., XLV., 136-145. Davenport, Statistical methods, p. 44, 2nd Edit., Lond., 1904. See also Pearson's, Yule's, and other papers on the subject.

the norm of increase, i.e., the characteristic of the increase of the whole of the populations to be compared. The latter involves the smaller corrections, and has the advantage that for many purposes the corrections will be negligible. Let it be supposed that the population is an increasing one: the data will then be characterised as follows:—

- (i.) The data for longer durations, drawn therefore from a smaller population, will be smaller (all other things being equal) than would characterise a constant population of the size from which the more recent data are drawn. Hence the necessary correction is a factor 1+e, where e is positive.
- (ii.) If the numbers of individuals have been taken into account for earlier dates, they can be deduced from the survivors, provided (a) that a correct mortality table is available, and (b) that migration has introduced no (material) modification.
- (iii.) If the data are related to events occurring with a varying rate (as in cases of birth, marriage, death, etc.), the rate at which they occur must be determined according to the duration in question.

The type-formula for correction is as follows:—Let N denote the number given at any point of time, that is, let N denote the *survivors* after the duration i, from N' persons; then if, in origination, N may be presumed to vary with the population, we shall have, on making allowance for the fact that these are only survivors, and that what is required is a result which shall either coincide (i.) with the final magnitude of the population, viz., at the date from which i is reckoned, or (ii.) with a definite rate of population growth (the rate of normal increase):—

$$(542) \dots N' = Ne^{\mu_i} L_{x-1}/L_x = Ne^{\mu_i} [1 + \frac{1}{2}(q_{x-1} + q_x)], *approximately.$$

<sup>\*</sup> See formula (530), p. 289. The notation is the ordinary actuarial notation. It is fairly obvious that  $L_{x-i}/L_x$  must equal  $1+\frac{1}{2}(q_{x-i}+q_x)$  i approximately. It will be found that, through a large range, this latter and arithmetically more convenient form is sufficiently accurate for correction purposes to the data of statistics of duration. For example, if 12 be taken as the lowest age (it is the age of least mortality for Australian females), and successive intervals of 10 years from this be also taken, the following results are obtained, viz.:—

x- $i$ and $x$	12-22	12-32	12-42	12-52
Exact formula	1.03114	1.0933	1.1861	1.3133
Approx. formula	1.03110	1.0893	1.1500	1.2888

Even the final difference is ordinarily of no moment, since, as a rule, the numbers to which it would have to be applied are very small.

In this  $\rho$  will denote in case (i.) the absolute rate of increase, and in case (ii.) the excess over the normal rate of increase. Certain events, however, for example births, marriages, and deaths, migration, etc., occur with a rapidity which fluctuates on either the positive or negative side of the general rate of increase of the population, in which case it may be necessary to introduce, into equation (542), a factor depending on the fact in question.

4. Distribution of partially and wholly unspecified quantities in tables of double-entry.—If a series of quantities, A, B, C, etc., and A', B', C', etc., fully specified so as to permit of proper double-entry, and others, a, a', etc., and a, a', etc., specified so as to permit only of single entry, and again a third set  $\omega$  not specified, so as to permit of entry under either of two series of headings, be tabulated or arranged as hereunder, and totalled, the result will be as shewn symbolically in the following table:—

TABLE XCVII.—Scheme of a Double-entry Tabulation of Defectively Specified Data.

Arguments	y	y'	y''	y'"	etc.	etc.	Specified as regards $x$ only.	Totals.
x	A	В	C	D	etc.	etc.	a (b)	S + a (S + b)
x'	A'	В′	C'	D'	etc.	etc.	a' (b')	S' + a'(S' + b')
x"	A"	В"	C"	D"	etc.	etc.	a" (b")	S'' + a'' (S'' + b'')
etc.	etc.	etc.	etc.	etc.	etc.	etc.	etc.	etc.
Specified as regards y only	α (β)	a' (β')	α" (β")	α"' (β'"')	etc.	etc.	ω (0)	$\frac{[\alpha+\alpha'+\ldots]+\omega}{(\beta+\beta'+\ldots)+0}$
Totals	T + a	T' + a'	T"+α"	$\mathbf{T'''} + \mathbf{a'''}$	etc.	etc.	$ \begin{array}{c} [a+a'+\ldots]+\omega\\ (b+b'+\ldots)+0 \end{array} $	$\frac{\Sigma S + \Sigma a + \Sigma a + \omega}{\Sigma T + \Sigma a + \Sigma a + \omega}$

In this type-table, the horizontal and vertical totals of the fully-specified quantities are respectively S, S', etc., and T, T', etc., but the aggregates of the rows are S + a, etc., and of the columns are T + a, etc. (i.e., for the fully specified quantities together with those specified as regards one particular only). The totals T + a are specified as regards the "arguments" in the horizontal headings, and the totals S + a are specified as regards the "arguments" in the vertical headings. Thus the grand total is  $\Sigma S (= \Sigma T) + \Sigma a + \Sigma a + \omega$ , and this is the sum of either of the series of totals, viz., that of the final column or that of the final row.

In order to distribute the quantity wholly unspecified, it is necessary to add a portion of  $\omega$  to the (vertical) columns, and a portion thereof to the (horizontal) rows, so that the corrected values of A, B,....A', B'..., etc., shall equal the grand total, and so that the adjustment

shall be the most probable. Such adjustment can be effected as follows: It is assumed that the division of the quantity  $\omega$  into two parts, viz.,  $\omega'$  and  $\omega''$ , proportional to the aggregates of the a and a quantities respectively, is the most probable apportionment of the doubly-unspecified quantity among the two, and further, that if these divisions,  $\omega'$  and  $\omega''$ , be again subdivided proportionally to the individual values of a, a', etc., and a, a', etc., the result will be the most probable subdivision. Let—

$$(543)....\omega = \omega' + \omega''$$
; and  $\Omega = \Sigma \alpha + \Sigma \alpha$ ; then

$$(544).....\omega' = \Sigma a \cdot \omega / \Omega$$
; and  $\omega'' = \Sigma a \cdot \omega / \Omega$ ;

consequently the amounts of the corrections to the a and a quantities are ascertained by multiplying each of them by the ratio  $\omega/\Omega$ , or what is the same thing, the required result is attained by multiplying by this factor increased by unity. Calling the adjusted numbers b and  $\beta$  respectively, their values are:—

$$(545).....b = a (1 + \omega / \Omega); \beta = \alpha (1 + \omega / \Omega).$$

Similarly, if these b and  $\beta$  quantities are distributed proportionally to the A, B, C, etc., quantities, and the A, A', A'', etc., quantities respectively, the required corrections are:—

(546)... A + a = A (1 + 
$$\frac{b}{S} + \frac{\beta}{T}$$
); B + b = B (1 +  $\frac{b}{S} + \frac{\beta'}{T'}$ ); etc.

(547)...A' + a' = A' 
$$(1 + \frac{b'}{S'} + \frac{\beta}{T})$$
; B' + b' = B'  $(1 + \frac{b'}{S'} + \frac{\beta}{T})$ ; etc.

and so on. The additive quantities, Ab / S, A $\beta$  / T, etc., are most readily computed separately, and are then added to the fully-specified quantities. By the process indicated, both series of singly-specified quantities, and the unspecified quantities are suitably distributed, the adjusted table consisting of the values A + a, B + b, etc.; and A' + a', B' + b', etc.

The process indicated is also valid when the distribution should be made on other bases.

Let  $a=a_1+a_2$ ;  $b=b_1+b_2$ ; etc.,  $a'=a'_1+a'_2$ ; etc., etc., the subdivisions being the values of Ab/S,  $A\beta/T$ , etc. Then, if the fundamental supposition that the corrections are proportional to A, B, etc., A', B', etc., be not satisfactory, any function of these quantities

may be substituted, in which case S and T will be  $\Sigma\phi(A)$ , and  $\Sigma\psi(A)$ , the former denoting the sum of the values of  $\phi A$ ,  $\phi B$ , etc., and the latter the sum of  $\psi A$ ,  $\psi A'$ , etc. The process is identical in all respects with the preceding one, when the substitutions of  $\phi A$  for A, etc., have been made.

In general, this method of distribution not only gives results of a very high degree of probability, but has also the advantage of being arithmetically very convenient.

5. Unspecified cases follow a regular law.—In general, the number of unspecified cases in any compilation exhibit great regularity. It will be sufficient to take two examples, which may be obtained from Tables CXIII. and CXIV. hereinafter.

According to the former Table, out of 733,773 wives, 21,151 made no statement as to the duration of marriage, but stated the number of children borne by them; 12,073 stated the duration of marriage, but omitted to state how many children were borne by them, and 3747 gave no information as regards either particular. See Census Report, Vol. III., pp. 1140-1. In the latter table, out of the same number, 5432 stated the number of children borne by them, but did not state their ages; 15,477 stated their ages, but did not state the number of children borne by them; and 343 gave no information as regards either particular: see Census Report, Vol. III., pp. 1136-7.

The regularity of distributions of the partially-specified cases is shewn by forming the ratios of the unspecified to the completely specified in the same category. The results are as follow:—

TABLE XCVIII.—Exhibiting the Regularity of the Ratios of those who Fail to Specify Particulars completely to those who do not so Fail.

Ratio to total who fully Specify, of	PARTICULARS SPECIFIED—ISSUE TO THE NUMBER OF—											
those who omit to State	,0	1	2	3	4	5	6	7	8	9	10	
Duration of Marriage Age	.0253 .0066	.0220 .0068	.0232 .0069	.0273 .0077	.0303 .0081	.0347						
-		I	Particui	ARS SPE	CIFIED-	-Issue	то тне 1	UMBER	or-			
	11	12	13	14	15	16	17	18	19	20	21, etc.	
Duration of Marriage Age	.0452 .0094	.0539 .0081	.0554 .0094	.0464 .0066	.0465 .0088	.0370 .0105	.0652 .0074	.0490 .0236	.0488	.0625 .0000	,1081 ,0208	

<sup>&</sup>lt;sup>1</sup> The ground of assurance as to this is indicated in the next section.

Table XCVIII.—Exhibiting the Regularity of the Ratios of those who Fail to Specify Particulars completely to those who do not so Fail—continued.

Ratio to total of those who fully		DURATION OF MARRIAGE.													
Specify, of those who Omit to State	0-4			-14 1	5-19	20-24	25–29	30-34	35-8	39 40-	-44	45-			
No. of Child- ren borne	.0216	.020	04 .01	.0	0104	.0142	.0137	.0130	.014	.0	124	.0151			
	AGES OF WIVES.														
	14	15_	16	17	18	19	20	21-24	25-29	30-34	35-39	40-44			
No. of Child- ren borne	.0000	.0000	.0148	.0105	.0107	.0161	.0234	.0215	.0209	.0198	.0201	.0212			
		-			A	ges of	WIVES								
	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85–89	90-94	95–99	100-04			
No. of Child- ren borne	.0207	.0236	.0238	.0263	.0290	.0349	.0378	.0642	.0824	.0625	.0000	2.0000			

From the above results it is evident that the number who fail to specify "duration of marriage" is a fairly definite function of the "number of children borne," and also that the number who fail to specify the "number of children borne" is also a fairly definite function of the "duration of marriage," (see the upper part of the Table). Also, the lower part of the table shews that those who omit to state the number of children borne is a fairly definite function both of the "duration of marriage," and—as might consequently be expected—of the "age of the wives." These facts justify, pro tanto, the distribution of the unspecified cases, and there is little reason to doubt the result, after distribution, has a much higher degree of probability than that which rejects all partially-specified cases.

Other tabulations disclose, in an equally striking way, the regularity of the numbers of the unspecified, and confirm the desirability of adjusting tabulations generally, in the manner indicated, before using the results. The use of the fully specified tabulation as proportionally correct is obviously not satisfactory.

6. Number of children at a confinement—a function of age.—By dividing for each age the number of cases of confinement into the number of children born, during a sufficiently long period, the average number of children at a confinement is found to vary with age: that is, B denoting children born, and M the number of their mothers:—

$$(548).....1 + \epsilon_x = B_x / M_x = f(x)$$

 $\epsilon$  denoting the excess over unity. Seven years' experience give the following results, the figures, however, being confined to cases of twins, that is, the third child in cases of triplets is not taken into account:—

TABLE XCIX.—Shewing Excess due to the Occurrence of Multiple Births according to Age in the Average Number of Children Born per Confinement, Australia, 1907–14.

	Nu	PTIAL CON	FINEMEN	TS.	Ex-1	NUPTIAL C	ONFINEM	ENTS.
Ama	Con-	Excess*	R	atio.	Con-	Excess*	Re	tio.
Age.	fine- ments.	over 1 Child.	Crude.	Smooth- ed.	fine- ments	over 1 Child.	Crude.	Smooth ed.
12	0		••	.0000	5			.0000
13	4			.0006	21			.0007
14	30	• •	• •	.0013	126	••	• •	.0014
15	170			.0019	537	1	.0019	.0021
16	1,138	2	.0018	.0026	1,500	2	.0013	.0028
17	3,962	12	.0030	.0032	2,980	11	.0037	.0035
18	9,761	35	.0036	.0038	4,504	15	.0033	.0042
$\overline{19}$	18,071	94	.0052	.0045	5,317†		.0041	.0049
20	25,159	148	.0059	.0051	5,272	30	.0057	.0056
21	35,326	203	.0057	.0058	5,008	32	.0064	
$\frac{21}{22}$	43,353	254	.0059	.0064	4,231	36‡	.0085	.0063
23	50,322	333	.0066	.0070	3,848	30+	.0078	.0077
$\frac{20}{24}$	53,175	394	.0074	.0077	3,182	26	.0078	.0084
25	54,259	453	.0083	.0083	0.540	10	20055	0001
26	55,006†	447	.0081	.0090	2,548 $2,161$	19	.0075	.0091
$\frac{20}{27}$	53,735	494	.0092	.0096	1,785	20 27	.0093	.0098
28	53,244	509	.0092	.0102	1,789		.0151	.0105
$\frac{26}{29}$	49,200	539	.0110	0.102	1,699 1,410	20 7	.0118 .0050	.0112
90	47.000	555	0116	0117				
30	47,980	484	.0116	.0115	1,356	17	.0125	.0126
31	40,199		.0120	.0122	851	10	.0118	.0134
$\frac{32}{33}$	41,528 37,426	5651	.0136	.0128	956	13	.0136	.0146
33 34	34,362	508 486	.0136 $.0141$	.0134 .0141	812 779	15 13	.0185 .0167	.0162
	0.1.0.40			1				1
35	31,349	445	.0142	.0147	688	17	.0247	.0200
36	29,399	496	.0169	.0154	636	12	.0189	.0190
37	26,213	419	.0160	.0160	544	7	.0129	.0160
38 39	24,664 20,790	380 326	$0.0154 \\ 0.0157$	.0163 .0158	555 436	9   5	.0162 $.0115$	.0135
	. ,				430	9	.0110	.0110
40	17,023	232	.0136	.0145	383	6	.0016	.0102
41	12,252	173	.0141	.0129	201	3	.0149	.0083
$\bf 42$	11,012	126	.0114	.0114	205	0	.0000	.0068
<b>43</b>	7,457	85	.0114	.0101	155	1	.0065	.0056
44	4,746	37	.0078	.0088	85	1	.0118	.0045
45	2,755	21	.0076	.0075	58	0	.0000	.0036
46	1,389	10	.0072	.0063	36	ĭ	.028	.0028
47	684	4	.0058	.0052	17			.0022
48	310	1	.0032	.0042	12			.0016
49	106	0	.0000	.0032	7		••	.0011
50	34	0	.0000	.0023	5			.0007
51	12	ŏ	.0000	.0016	1†	••	• •	.0004
52	6	ĭ l	.1666	.0009	0		• •	.0004
53	4	1		.0005	ĭ		• •	.0002
<b>54</b>	3	::	••	.0003		::	• •	
Total	897,618	9,271	.001032	<u> </u>	54,913	428	.000778	<del>-</del>

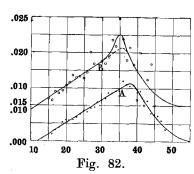
<sup>•</sup> Triplets are included in the result. † Maximum for confinements, excess for multiple births. ‡ Maximum

The results shewn indicate that the increase with age, x, is as follows:

$$(549).....\beta''_n = 1 + 0.00064 (x - 12);$$
 up to age 37.

$$(550).....\beta_{4} = 1 + 0.00070 (x - 12);$$
 up to age 30 (?)

The excess of over is the quantity  $\epsilon$  in (548). Probably the age 37 could be adopted in both cases. For later ages, Table XCIX. must be con-



Curve A shews by a continuous line the smoothed curve of the excess over I at a birth, according to the age of the married mother; and Curve B similarly shews the results for unmarried mothers. The dots and circles shew the crude results.

sulted, and the values are uncer-As the numbers are small tain. this fact is, however, of little moment. Later, the case will be more fully analysed, for example, in regard to the duration of marriage, etc. Curves A and B, Fig. 82, shew the nuptial and ex-nuptial results respectively. The nuptial maximum is 0.0163 for age 38.4, and the exnuptial maximum is 0.0201 for age 35.5. The numbers after age 44 in the nuptial, and after age 36 in exnuptial cases are so small as to make the results for later ages doubtful, and the somewhat wide dispersion of the ex-nuptial results then probably is large for the later ages.

7. Relative frequency of multiple births.—For the period 1881 to 1915, the relative frequencies of twins, triplets, and quadruplets were as follow:-

TABLE C .- Multiple Births, Australia, During 35 Years, 1881-1915, and for Other

	Population Aggregate.*	Female Population Aggregate.*	Con- finements.	Cases of Twins.	Cases of Triplets.	Cases of Quad- ruplets.	Cases of Quin- tuplets.
Numbers Ratios , , , , , , , , , , , ,	113,900,167 34,208,424 		3,329,594 1,000,000 102,02 12,064 665,919	32,636 9,802 1 118,25 6,527	276 82.9 .00846 1 53.2	5 1.50 .00015 .0188	0 0 0 0
Year.	Authority.	Total Births.	Con- finements	Cases of Twins.	Cases of Triplets.	Cases of Quad- ruplets.	Cases of Quin- tuplets.
1871-80 1872-80	Neefe† Prinzing‡ Knibbs	50,000,000 63,000,000 German Em- pire	1,000,000 1,000,000 1,000,000§	12,080 11,677 12,856	156 143 124	1.8 1.3 1.33	0.25¶

Sum of the mean annual populations of the Australian States for which the necessary birth

statistics were taken out.

† Zur Statistik der Mehrgeburten. Jahr. f. Nat. u. Stat., 1877, Bd. XXVIII., p. 174.

‡ Medizinischen Statistik. H. Prinzing, p. 65.

§ Confinements 12,013,134; Twins 154,444; Triplets, 1489; Quadruplets, 16; in the German Empire.

¶ Based on 15,965,391 children born, excluding still-births about 15,758,822.

Quintuplets have been reported by Volkmann, Düsseldorf; by A. Bernheim,<sup>2</sup> Philadelphia; by Horlacher,<sup>3</sup> Württemberg; by Nyhoff,<sup>4</sup> Groningen; in 30 cases collected by the last-named, the majority were born at between 4 and 5 months.

Sextuplets are reported by Vassali,<sup>5</sup> and Vortisch, Alburi,<sup>6</sup> and sextuplets at Hameln in Westphalia in 16007; no cases, however, so far as I am aware, have been reported in Australia.

The observed frequency of multiple births is as follows:—

TABLE CI.—Relative Frequency of Twins in Various Countries.\*

Country.		Period.	Frequency.	Country.	Period.	Frequency
Australia Spain Roumania France Belgium		 1863-70 1871-80 1899-1902 1890, 5,	 .0087 .0088 .0109 .0111	Switzerland Germany Baden Prussia Netherlands	1901–1902 1891–1900 ,,	.0127
Italy Russia Bavaria Saxony Austria	• • • • • • • • • • • • • • • • • • • •	1891–1900 1887–91 1891–1900 1896–1900	.0121 .0123 .0123	Hungary Württemberg Norway Sweden Finland	1876–1880 1871–80	.0132 .0133 .0146

<sup>\*</sup> The results other than for Australia are given in H. Prinzing's "Handbuch der medizinischen Statistik, p. 64.

The frequencies, however, have wide ranges of values. Thus, in Italy, they ranged in the period 1892-1899 through .0080 for Basilicata, to .0148 for Venice. For rough approximations the order of frequency with which twins, triplets, etc., occur, is as follows:-

Confinement.	Twins.	Triplets.	Quadruplets. .000001	Quintuplets .0000002
--------------	--------	-----------	-------------------------	----------------------

Uniovular and diovular multiple births.—Observations as to the frequency of what may be called uniovular and diovular production of twins shew (i.) that the sexes are the same where the twins are produced by the division of a single ovum; (ii.) that this occurs in about one-fifth or one-fourth of the cases, these being recognised by the fact that they have common chorion; and (iii.) that where the twins are produced from two ova, the sexes may be identical or otherwise, these being recognised by the fact that the chorion is divided.

<sup>Zentral bl. f. Gyn., 1879, p. 17.
Deutsche med. Wochenschrift, 1899, p. 274.
Horlacher, Württ., Korr. Bl. 1840.
Zeitschr. f. Geb. u. Gyn., 1903, Bd. lii., p. 173.
Anatom. Anzeiger, Bd. x., No. 10.
Münch, med. Wochenschr., 1903, No. 38, pp. 1639-40 a photograph is given. Date of birth, 9th January, 1600.
Deutsche med. Wochenschr., No. 19, 1899, p. 312.</sup> 

Statistics for an examination of this question are not available in Australia, but are available for the German Empire. The data for 1906 to 1911 inclusive are as follows:—

TABLE CII.—Frequency of Multiple Births (German Empire, 1906-11).

Confinements.	2 Males.	Pairs.	2 Fe- males.	3 males.	2m.,1f.	1m.,2f.	3 Fe- males.	Males Born.	Females Born.	Total
12,013,134	49,425	58,382	46,637	343	390	395	361	28	36	Quin- tuplets.*
Children Born.	Total (	Total Cases of Twins.			d Cases	of Tri	plets.	Total C Quadr	(uploss.	
12,170,604 10,000,000†	154,444 128,563				1,489 1,239.5				6. 3.3	3. 2.54

<sup>\*</sup> This is-based upon 15,965,391 children born; or about 15,758,800 confinements in 1872 to 1880, during which time 4 quintuplets were born. † This would give the proportion 3.05. As is evident for the number of children, the twins must be multiplied by 2, the triplets by 3, etc.

The proportion  $(\xi)$  of uniovular cases can be deduced at once from the preceding figures. Let  $\mu$  denote the masculinity, defined as the ratio of the difference of the pairs of males and pairs of females to their sum; see (335), p. 132. Obviously, the uniovular cases are in the ratio  $(1+\mu)$  pairs of males to  $(1-\mu)$  pairs of females. The diovular cases are in the same ratio as regards the same pairs, and the mixed pairs are equal to both combined, that is they are:—

TABLE CIII.—Theoretical Distribution of Diovular and Uniovular Cases Among Cases of Twins.

Total T	2 males	:	Male and female	+	Female and male	:	2 females
$T (1 - \xi)$ $T \xi$	$1 + \mu$ $1 + \mu$	:	1 0	++	1 0		$\begin{array}{ccc} 1 & - & \mu \\ 1 & - & \mu \end{array}$

Of the total there are  $\xi$  uniovular and  $(1-\xi)$  diovular cases : consequently—

$$(551).....\xi = \frac{M+F-P}{M+F+P}; \text{ and } \mu = \frac{1}{2} \cdot \frac{M-F}{M+F}$$

M denoting the number of pairs of males, F the pairs of females, and P the cases of one of each sex. The above results thus give  $\xi=0.24397$  and  $\mu=0.029023$ .

Direct observations according to Weinberg<sup>1</sup> and Ahlfeld<sup>2</sup> gave respectively for the relative frequency of uniovulate cases 0.21 and .0172, but it would appear from the preceding result that a sufficiently extended number of cases could be expected to give a higher ratio.

<sup>&</sup>lt;sup>1</sup> Beiträge zur Physiologie und Pathologie der Mehrlingsgeburten beim Menschen. Archiv f. ges. Physiol., 1901, Bd. lxxxviii, p. 346; Neue Beiträge zur Lehre von den Zwillingen. Zeit. f. Geb. u. Gyn., 1903, Bd. xlviii., H. 1.

<sup>&</sup>lt;sup>2</sup> Zeit. f. Geb. u. Gyn., 1902, Bd. xlvii., p. 230.

A similar investigation may be applied to the more limited results for triplets. Neglecting the masculinity tendency, it is obvious that for the triovular and diovular cases the proportions of cases in each category will be respectively:—

TABLE CIV.—Theoretical Distribution of Diovular and Triovular Cases Among Triplets.

Total T	3 males :	2 males and 1 female:	: 1 male and 2 females : $(Q)$	3 females (F)
$\frac{T(1-\xi')}{T\xi'}$ .	.125	.375	.375	.125
	.25	.25	.25	.25*

<sup>\*</sup> It is assumed that when the births m.f.m and f.m.f occur, the chance of the two males or two females being uniovular is zero. If this condition were not physiologically impossible, it is easy to see (by exhaustive enumeration) that the probabilities of the four cases would be 0.2:0.3:0.3:0.2.

An examination of the individual figures for each year shews that the differences are too great to give any ground for deducing masculinity to be other than zero. Hence we may take means adopting:—

352:392.5:392.5:352 instead of 343:390:395:361. and this gives for the series of triovular and diovular births respectively:

20.25:60.75:60:75:20.25 and 331.75:331.75:331.75:331.75,

or 162 triovular and 1327 diovular births in all; or ratio of diovular cases of no less than 0.8912 of the total, the triovular being 0.1088. Thus it follows that triovulation is a much rarer occurrence than the production of uniovular twins, that is, the ratio of triovulation in triplets to diovulation is 8.20. From the above we obtain by symmetrically including all the data:—

$$(552).....\xi' = \{3 (M + F) - (P + Q)\} / (M + P + Q + F).$$

Thus, according to the recent experience of the German Empire, we have for 10,000,000 cases of confinement, 31,365.5 cases of uniovulation production of twins among the twins, and 1104.6 cases occurring among the triplets. We may assume at least the same ratio for the cases of quadruplets and quintuplets, which will give, say, 14.1 for both combined. Hence the ratio  $\zeta$  of occurrence for all cases of uniovular production of twins (i.e., appearing as twins or as portion of triplets, &c.):—

$$(553).....\zeta = 0.0032484.$$

or, say, 13 cases in 4000, or 1 case in 308.

¹ In quadruplets there are 16 possible orders in which births may occur, and in these 24 possible cases of uniovulation. Since, however, the number of males and females are unequal—28 and 36—the possible cases have not occurred, and hence we may regard the 16 quadruplets and 3 quintuplets as roughly expressing the probable number of cases. Schreder (Lehrbuch der Geburtshülfe, 10° aufl.) gives for twins 1:89, triplets 1:7910, quadruplets 1:371126.

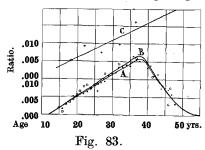
9. Small frequency of triovulation.—The preceding analysis appears to shew that the triovular cases are only 162 in 12,013,134 confinements. The probability of triovulation,  $\zeta'$ , therefore, would appear to be :—

$$(554).....\zeta' = 0.00001348.$$

or, say, I case in 74,000 confinements, though triplets occur at the rate of I case in 8068 confinements in the German Empire. This subject might well form the result of more definitive study when the data are adequate.

10. Nuptial and ex-nuptial probability of twins according to age.— The probability, in any nuptial or in any ex-nuptial confinement, of the

Frequency of Twins according to Age.



Curve A represents the ratio of the number of cases of at least two births to the number of nuptial confinements.

Curve B represents the same ratio for ex-nuptial confinements.

Curve C represents the number of cases of three or more at a birth to the number of cases of two or more.

occurrence of twins has been analysed from an aggregate of the Australian data from 1908 to 1914, both It must, of course, be inclusive. in substantial agreement with the result found for  $\epsilon$  in §8. Table CV., columns (ii.) and (vi.), give the number respectively of nuptial and ex-nuptial confinements (totals 897,618 and 54,913) occurring in Australia in 8 years, and the numbers of twins corresponding to each, viz., 9187 and 422. These are shewn by curves A and B, Fig. 83, the dots denoting the individual results for nuptial cases, and the firm lines the smoothed results; the values for the latter being given in column (v.) of the table. The exnuptial cases are denoted by circles,

and where the numbers were small, the quinquennial aggregates only were graphed. The rate of increase per year of age up to age 37 is for nuptial and ex-nuptial cases respectively.

$$(555)$$
..... $\epsilon_a = 0.000632$   $(x - 12)$  and  $\epsilon'_a = 0.000668$   $(x - 12)$ 

x being the age of the mother. Beyond the age in question the results can be taken from the table. The ratios for all ages are—nuptial, 0.010234, and ex-nuptial, 0.00768. The general result is (i.) that with increase of age (and possibly duration of marriage) the frequency of twins increases linearly, till the end of the ordinary child-bearing period is approached, and (ii.) this increase is slightly greater for ex-nuptial cases, viz., about 5.7 per cent. greater. The ex-nuptial relative frequency of

twins for all ages combined is exactly 0.75 the nuptial relative frequency. Since in the ex-nuptial cases the confinements are probably on the whole not repeated, the result would appear to be due to age. This matter will be further considered later.

TABLE CV.—Shewing Probability according to Age of the Occurrence of Nuptial and Ex-nuptial Twins, and of Triplets, based on 8 Years' Australian experience, 1907-1914.

	Manutical		Freque		Ex-	G		ency of		!	Ratio
	Nuptial Con-	Cases '	Nuptial	Twins.	Nuptial Con-	Cases of Ex-	Twi	ns.	Áll	All	_ of
Age.	fine- ments.	Nuptial Twins.	Crude	Smo'th-	fine- ments.	Nuptial Twins.	Crude.	Smo'th-	Twins.	Triplets	Triplets to Twins.
					\ <u> </u>						<u> </u>
(i.)	(ii.)	(iii.)	(iv.)	(v.)	(vi.)	(viii.)	(vii.)	(ix.)	(x.)	(xi.)	(xii.)
12	0	0	0	.0000	5			.0000			.0030
13 14	4 30	0	0	.0006	21 126	0	,0000	.0007	::		.0035
	34		::		152			l			
15	170	0 2	ممنو	.0019	537	1	.0019	.0020	• • •	• • •	.0044
16 17	1,138 3,962		.0018	.0025	1,500 2,980	1 9	.0007	.0027			.0049
18	9,761	36	.0037	.0038	4,504	16	.0036	.0040	::	::	.0058
19	18,071	94	.0052	.0044	5,317	23	.0043	.0047			.0063
20	33,102	144	.0058	00:1	14,838	50	.0337	00:0	194	1	00.52
20 21	25,159 35,326	147 202	.0057	.0051	5,272	27 33	.0051	.0053	::	1 3	.0068
22	49 959	954	.0059	.0063	4,231	34	.0080	.0067	::	1	.0077
23	50,322	329	.0065	.0069	3,848	32	.0083	.0073		6	.0082
24	1 53.175	1 392	.0074	.0076	3,182	24	.0075	.0080	1 484	3 14	.0086
25	207,335 54,259	1,324 452	.0083	.0082	<b>21,541</b> 2,548	150 21	.0082	.0087	1,474	14	.0091
26	55,006	434	.0079	.0088	2,161	19	.0087	.0094	::	3	.0096
27	53,735	487	.0091	.0095	1,785	25		.0100		8 5 2	.0101
28	53,244	506	.0095	.0101	1,699	23		.0107		5	.0105
29	49,200 <b>265,44</b> 4	538 2.417	.0109	.0107	1,410 9,603	96	.0100	.0114	2.513	19	.0110 .0076
30	47,980	548	.0114	.0114	1,356	14	.0100	.0120	2,010	7	.0115
31	40,199	485	.0121	.0120	851	13		<b>£</b> 0127		4	.0119
32	41,528	559	.0135	.0126	956	11		.0134		8	.0124
<b>3</b> 3 34	37,426 34,362	505 2 488	.0135	.0133	812 779	15 15		.0140	•••	3 4	.0129
94	201.49		.0142	.0139	4,754	68	.0143	.0147	2,653		.0098
35	31,349	436	.0140	.0145	688	17		.0154		10	,0138
36	29,399	488	.0166	.0152	636	9		.0160		12	.0143
37 38	26,213 24,664	3 414 4 377	.0158	.0158	544 555	7		.0167		5 4	.0148
39	20,790	324	.0156	.0156	436	8 5		.0163	1 :-	3	.0157
	132,41	2,039	1	J	2,859	46	.0161	·	2,085	34	.0163
40	17,023	226	.0133	.0143	383	6		.0150		6	.0162
$\frac{41}{42}$	12,252 11,012	$\begin{bmatrix} 2 & 171 \\ 2 & 123 \end{bmatrix}$	.0140	.0127	201 205	3 0	• • •	.0134	••	2 2	.0166
43	7.45	7 85	.0112	.0099	155	1 1	1 ::	.0104	::	0	.0176
44	7,45' 4,74	6 36	.0076	.0086	85	1		.0090	::	1	?
5:2	52.490	D 641	1 .::-		1,029	11	.0107	. : : -	652	11	.0169
45 46	2,758 1,389	5 21 9 10	.0076	.0074	58 36	0	•••	.0077	• • •	••	7
46 47	1,38		.0060	.0052	17	0		.0052		::	
48	310	) 1	.0032	.0041	12	0		.0042		::	
49	100	6 0	• • •	.0031	7	0	1	.0032		1	?
50	5,244	4 36		.0022	130 5		.0077	.0023	37		.0000
50 51	12		::	.0022	1			.0023	1 ::		?
52	(	6 1	.17	.0009	l õ			.0009	::	•::	?
53	1 :	4		.0005	1			.0005	• •		?
<b>54</b>	5	3 9 1	· · ·	.0002			• •	.0002	1		.0000
Not Stated		9 1	··		-	••		••	1		.0000
Totals	897,618	9,187	.01023		54,913	422	.00768		9,609	105	.01093

<sup>11.</sup> Probability of triplets according to age.—The results of the 8 years, 1907-14, gave the following results for nuptial and ex-nuptial twins and triplets, viz.:—

		Twins.		Triplets.				
	Nuptial.	Total.	Ex-nuptial.	Nuptial.	Total.	Ex-nuptial.		
Numbers Ratio	9,187 1.0000	(9,609)	422 .0459	98 1.000	(105)	7 0.071		

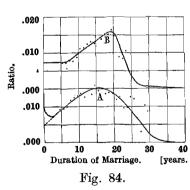
The numbers are too small, however, to establish that the frequency of the occurrence of triplets ex-nuptially is between 50 and 60 per cent. greater than nuptially.

If the frequency be related to the number of twins, it is roughly given by the smoothed results in column (xii.) of Table CV. We shall call the probability  $P_3/P_2$  say,  $\tau_s$ . Thus we shall have:—

$$(556)\dots\tau_3 = 0.0030 + 0.00047 (x - 12); \text{ or } = 0.00047 (x - 5.6)$$

the second form, however, being without meaning till the age of child-bearing. The firm line, curve C, on Fig. 83, denotes the increase; the crosses represent the group results used in deducing this.

- 12. Probability of twins according to duration of marriage.—Given a birth, the probability of a second child being born is found by dividing the number of twins, including triplets, by the number of confinements tabulated according to duration of marriage. Thus, column (v.) in Table CVI. is found by dividing the figures in column (iii.) by those in column (ii.). The crude results are shewn by the dots in Fig. 84, and the smoothed results by the firm line, curve A. For the form of the initial part of the curve see § 14, and also Fig. 85 hereinafter.
- 13. Probability of triplets according to duration of marriage.—The probability of a third child being born may, as before, be referred to



Curve A denotes the frequency of the birth of two or more children to the number of confinements.

Curve B denotes the ratio of 11-year means of the number of triplets to the number of cases of two or more children.

the number of cases where a second child has been born. This probability is found by dividing the number of triplets by the number of twins, including the triplets, etc. But the numbers to be dealt with are so small and irregular that the expedient was adopted of forming groups of eleven. As no correction was applied for the systematic error of the grouping, the curve represents the ratio of 11-year groups of duration of marriage, the argument being the central years of the group. The results are shewn on Fig. 84, curve B, and the data are shewn in Table CVI., and seem to indicate the change with duration of marriage is sensibly a linear one through for the major part (presumably) of the child-bearing period.

TABLE CVI.—Probability of Twins\* and Triplets† according to Duration of Marriage. Australia, 1908-1914.

Dura- tion of Mar-	Con- finements	Twins including	Triplets.		Twins to ements.		Criplets to oups of 11).
riage.		Triplets.		Crude.	Smoothed	Crude.	Smoothed
(i.)	(ii.)	(iii.)	(iv.)	(v.)	(vi.)	(vii.)	(viii.)
0-ì	134,171	1,129	9	.0084	0084		.0073
1-2	61,213	460	3	.0075	.0075		.0073
2-3	64,229	465	4	.0072	.0072		.0073
3–4	70,317	564	3	.0080	.0080		.0073
4-5	59,407	551	2	.0093	.0090		.0073
5~6	53,275	504	4	.0095	.0098	.0074	.0073
6-7	47,250	468	1	.0099	.0106	.0072	.0075
7-8	41,713	492	3 7 3 5	.0118	.0113	.0078	.0080
8-9	37,115	466	7	.0125	.0120	.0077	.0087
9 - 10	32,170	417	3	.0130	.0126	.0088	.0095
10-11	29,607	404	5	.0136	.0132	.0112	.0102
11-12	25,887	328	2 .	.0127	.0138	.0115	.0109
12-13	23,372	352	5	.0151	.0143	.0125	.0117
13-14	20,339	273	2	.0134	.0148	.0130	.0124
$14\!-\!15$	17,572	281	6	.0160	.0152	.0128	.0131
15 - 16	15,217	228	9	.0150	.0154	.0138	.0138
16-17	13,271	196	2	.0148	.0152	.0139	.0146
17-18	11,617	159	1	.0137	.0149	.0153	.0155
18 - 19	10,073	139	0	.0138	.0145	.0152	.0158
19 - 20	8,520	117	$\begin{bmatrix} 2 \\ 2 \end{bmatrix}$	.0137	.0139	.0164	.0158
20 - 21	7,424	89	2	.0120	.0132	.0149	.0149
21 - 22	5,988	76	0	.0127	.0124	.0087	.0121
22 - 23	4,726	46	1	.0097	.0114	.0083	.0095
23 - 24	3,561	35	0	.0098	.0103	.0105	.0068
24 - 25	2,664	34	0	.0128	.0092		.0043
25 - 26	1,809	22	0	.0122	.0080		.0028
26 - 27	1,146	8	0	.0070	.0067		.0016
27-28	643	2	0	.0031	.0054	·	.0010
28 – 29	383	4	1	.0104	.0041		.0006
29 - 30	192		0		.0028		.0003
30-31	77		١		.0016		.0002
31 - 32	45		l		.0010		.0002
32-33	. 16		l	l	.0006		.0001
33 - 34	5		l		.0004		.0001
34 - 35	0				.0003		.0001
35~36	ì				.0002		.0000
Totals	805,015	8,308	77	.010320		.00927	•••

<sup>\*</sup> That is, of two or more occurring at a birth. † That is, of third child in any case where two are born.

<sup>14.</sup> Remarkable initial fluctuation in the frequency of twins, according to interval after marriage.—There is no known ground for supposing that the ratio of the number of twins to the number of confinements in which they occur, can in any way depend on the interval after marriage, at least, if that interval be small. The results in Tables CVII. and CVIII.

hereunder for the years 1908 to 1915 and 1908 to 1914 respectively, shew, however, that apparently the dependence exists. The average for the first three months after marriage equals that of the third three months, and both are very much above the average. The second and fourth periods of three months are about equal. These results are shewn by curve C on Fig. 85.

TABLE CVII.—Shewing Variation in the Frequency of Twins during the First 24 Months after Marriage. Australia 1908-1915.

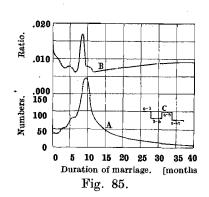
Year.	Twins Born during Interval after Marriage of Months					Con	finemer fter Ma	its duri rriage	ng Inte	ervals ths	Ratio of Twins during Intervals after Marriage of Months				
	0-3	36	6-9	9–12	12-24	0-3	3-6	6-9	9-12	12-24	0-3	3-6	6–9	9-12	12-24
1908	16	24	34	56	60	1,533				6,298		.0076	.0085	.0080	.00951
1909	21	26	44	62	48	1,799	3,556			6,973	.0116	.0073	.0106	.0085	.0068
1910 1911	19 15	29	58 49	59 64	48	1,888					.0101	.0079	.0129	.0079	.0069
1912	27	$\frac{31}{32}$	60	61	56 60	1,987			7,877	7,400	.0076	.0076	.0094	.0081	.0075
1913	17	34	61	66	65	2,119	4,458		8,899		.0127	.0072	.0103	.0069	.0071
1914	14	32	58	60	63	2,107 2,080		5,916 5,897	9,301 9,185	9,142 9,247	.0081	.0076	.0103	.0071	.0071
1915	28	46	51	76	82	2,023					.0099	.0111	.0088	.0086	.0069 .0091
Totals	157	254	415	504	482	15,536	31,819	41,307	65,871	63,450	.01010	.00798	.01005	.00765	.00760

Thus the proportion of twins for all pre-nuptial conceptions is high. It is to be noted, however, that the proportion of ex-nuptial twins over all is low (see Table CV.), and it is not unlikely that the initial high rate, and, in general, the higher rate for the cases due to pre-nuptial insemination is due to the transfer, owing to the *peithogamic* in fluence, of what might have been ex-nuptial to the nuptial cases. To obtain the fluctuation more exactly, the results were taken out monthly, from 1908 to 1914, according to interval after marriage.

TABLE CVIII.—Shewing Variations in the Frequency of Twins for each Interval of One Month after Marriage (First Births only), and of Triplets. Australia 1908-14.

Interval* Twins Confinements	0-1 39 3,529					5-6 83 11,160	6–7 85 13,870	7-8 109 11,545	8-9 170 10,064	9-10 195 24,434		11–12 87 13,595	0-12 1,129 133,738
Ratio	.0110	.0098	.0084	.0073	.0077	.0074	.0061	.0094	.0169	.0080	.0076	.0064	.00844
Interval† Twins Confinements;	::  -:	100	2–3 141 5,801	3-4 58 6,458	4-7 59 6,413		11–26 7 905	682		11   3	nterval Triplets Cwins	0-1 8 1,129	1-26 6 682
Ratio		073	0089	.0091	.0092	.0077	.0078	.00790	.008	23 ]	Ratio	.0071	.0088

Months. † Years. First births.



Curve A denotes the actual number of twins in Australia during 7 years' experience.

Curve B denotes the ratio of cases of births of 2 or more children to cases of confinement. .

Curve C denotes, similarly to curve B, the group ratios for three months, however, instead of one.

The ratio for 1-4 is .0078, and for 5-26 is .0087. The numbers for the lesser subdivisions are doubtless too small to rely on the results. The results shewn are for *first births* only; but for the smaller durations the distinction is without meaning. Fig. 85 shews the results, curve A denoting the actual number of twin births, and curve B the frequency with which twins occur.

15. Frequency of twins according to order of confinement.—From the frequency of the occurrence of twins according to previous issue, an estimation according to order of confinement can be made by taking account of the probability of twins or triplets, &c. From the frequency according to previous issue, it may be

deduced that the probability of twins is approximately as follows:—

Previous Confinements Probability (about)	.0096	.0107	.0117	.0124	.0130	6 .0134	.0136	.0138	.0139	10 .0140
				<b>,</b>					i	

We have also from the general result that the frequency of single births, twins, and triplets in Australia was, for 1908-14,

The probability of twins occurring twice,  $_2p_2$ , is, therefore, approximately identical with that of the occurrence of triplets,  $p_3$ , that is:—

(557).....<sub>2</sub>
$$p_2 = p_2^2 = p_3$$
, approximately.

The number entered under 0 will be correct. That is, the cases "according to previous issue," and "according to previous confinements" are identical. But in every case where there were twins or triplets, etc., at the first birth, the cases would be tabulated under "previous issue," 2 or 3, etc., respectively, instead of under 2; and similarly mutatis mutandis for all later columns in the "according-to-previous-issue"

tabulation. We therefore must add the appropriate numbers, and deduct equal numbers from later columns. The precision of the result will, of course, never be of a high order.

The data are given in the upper part of Table CIX., and the approximate restatement according to the order of confinement forms the lower part of the table.

TABLE CIX.—Frequency of Multiple Births according to Previous Issue. Australia 1908-14.

Previous Issue (upper table), or Order of Confinement (lower table.)

Numbers.	0	1	2	;	3	4	• 5	6	7	7	8		9
Cases of at least 2 children Cases of at least	1,811	1,35	67 1,5	325 1	,094	834	591	47	7	306	22	7	127
3 children Mothers of at	12	1	.0	7	7	8	5	(	9	2		4	1
least 1 child Ratio of twins	220,807	167,09	125,7	779 92	,116	65,343	46,156	31,735	21	,918	14,72	7 9	9,671
to mothers	.00820	.00812	.010	053 .0	1188	.01276	.01280	.0150	.01	1396	.0154	1 .0	1313
Ac- cord- Twins	1,811	1,38	36 1,	337 1	,096	831	590	467	7	302	21	8	122
ing to order Mothers	220,807	169,85	126,	377 92	,083	65,099	45,683	31,25	3 21	,467	14,28	7 9	9,254
Con- fine- ment Corres- ponding Ratio	.00820	.0081	.016	0.58	1190	.01277	.01292	.0149	.0:	1407	.0152	.0	1318
Ratio Triplets Smoothed	.000055	.00000	.000	074 .00	0088	000106	.000130	.00015	3 .00	0193	,00028	.00	00286
Numbers.	10	11	-12	13	14	15	16	17	18	19	20	21	22
Cases of at least 2 children Cases of at least	79	39	21	9		2	1	0	0	0	1	0	1
3 children Mothers of at	. 0	0	0	0	(	) (	1	0	0	0	0	0	0
least 1 child Ratio of twins	5,694	3,181	1,665	814	388	144	59	25	6	3	1	0	_1_
to mothers	.01387	.01226	.01261	l			0.0	01388					
Ac- Twins	74	37	19	8		5 2	1	0	0	0	1	0,	1
order of	5,378	2,964	1,530	740	340	127	52	21	5	2	0	1	1
Con- fine- ment Corres- ponding Ratio	.01376	.01248	.01242	.01081	.0147	.0157	.01923						

Since the correction system affects the number of twins and the mothers in the same way, it obviously cannot produce any appreciable difference in the ratios, though it may alter the numbers. This is seen in the results given in the table above. If the number of triplets be smoothed, the result shewn in the final line is obtained. But the numbers are too small to lead to any reliance upon their value, though they confirm in a general way the dictum that multiple fecundity increases with the issue, thus also with age and duration of marriage.

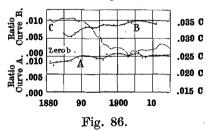
TABLE CX.—Shewing Secular Variation in the Frequency of Twins and Triplets. Australia, 1881-1915.

			Triplets.	Austral	a, 1881-1	rato.		
Year.		Cases of	Cases of	Cases of		f Twinst nements.		f Triplets ns, etc.;
	(Total).*	Children.	Children.	Children.	Crude.	Smoothed.	Crude.	Smoothed.
(i.)	(ii.)	(iii.)	(iv.)	(v.)	(vi.)	(vii.)	(viii.)	(ix.)
1881	63,818	545		0	.00854	0800.		
2	64,069	496	3 2 8 3	0	.00774	.0082		
3	68.135	575	2	0	.00843	.0084	• •	
4	72,832	629	8	0	.00863	.0086	.0063	.0063
5	76,026 79,009	661 682	2	Ö	.00869 .00863	.0087 .0088	.0056	.0056
6	83,085	704	4	ŏ	.00847	.0090	.0054	.0056
8	86,393	875	6	liil	.01012	.0096	.0066	.0062
9	87,195	859	3	0	.00985	.0099	.0068	.0070
1890	91,030	910	5	0	.00999	.0102	.0072	.0076
1	91,734	941	4	0	.01025	.0103	.0083	.0081
2	91,980	784	12	.0	.01023	.0102	.0082	.0082
3	90,379	899	11	1 1	.00994	.0100	.0080	.0081
4	86,384	797	7	0	.00922	.0096	.0081	.0081
3 4 5 6	91,225	907	12	1	.00994	.0094	.0085	.0085
	86,526	775	4	0	.00895	.0094	.0089	.0088
7	90,614	960	5	1 1	.01059	.0099	.0085	.0089
8 9	88,993	883 971	9	0 0	.00992	.0104	.0086	.0088 .0087
-	90,244			_	.01075	.0107		
1900	92,057	985	7	0	.01069	.0108	.0084	.0086
1	92,826	1,005	11	0	.01082	.0107	.0089	.0088
2	92,852	972	12	0	.01046	.0104	.0088	.0092
3	89,060	877	10	1 1	.00984	.0102	.0098	.0095
4	93,973	1,005	9	0	.01069	.0104	.0093	.0097
5 <b>6</b>	95,060 97,867	1,012 1,083	11 5	0	.01064 $.01106$	.0107 .0107	.0099	.0099
7	100,161	951	13	0	.00949	.0102	.0099	.0099
8	110,491	1.065	6	ŏ	.00963	.0098	.0100	.0097
9	112,921	1,142	14	ŏ	.01011	.0100	.0096	.0096
1910	115,609	1,189	13	0	.01028	.0102	.0092	.0093
1	120,957	1,236	14	Ŏ	.01021	.0102	.0093	.0089
2	131,726	1,350	. 16	0	.01024	.0101		
3	134,343	1,369	. 8	Ō	.01019	.0101	••	
4	136,576	1,406	11	0	.01029	.0102		• •
	133,444	1,417	10	0	.01061	.0104	••	••
Tot'ls	3,221,594	32,917	281	5§	.010217		.00853	
	I	I	I			1		I

<sup>•</sup> That is, nuptial and ex-nuptial. † Including triplets and quadruplets. ‡ That is, the ratio of 9-year groups of triplets including quadruplets to 9-year groups of twins, including triplets. § Ratio of quadruplets to triplets = 0.018.

16. Secular fluctuations in multiple-births.—The ratio of multiple births to confinements would appear a priori to be independent of time,

### Secular Fluctuation in Relative Frequency of Births and Twins and Triplets.



Curve A denotes the smoothed secular fluctuation of the ratio of births of two or more to the number of confinements.

Curve B denotes the ratio of 11-year groups of births of three or more to the number of births of two or more.

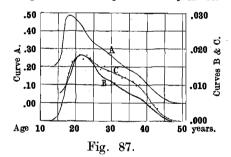
Curve C denotes the crude birth rate and number of births per unit of the general population.

but it will be seen from Fig. 86 that there are indications of a definite secular fluctuation, see Table CX. above. number of confinements which constitutes the basis of the experience is more than doubled in the 35 years under review (see column ii.), and the number of twins (which includes triplets and quadruplets) is large. The aggregate experience includes 3,221,594 confinements, in which there were a total of 32,917 births of two or more children, a total of 281 births of 3 or more children, and 5 quadruplets. These give the ratios shewn in the table. In Fig. 85, curve A is the smoothed secular fluctuation-curve of the twins; curve B that of the triplets (which

were grouped in nines); while curve C shews the fluctuations of the crude birth-rates for the same years. The individual values are shewn by dots. It will be observed that on the whole the frequency of twins and triplets rises as the frequency of births diminishes.

17. Comparison of nuptial and ex-nuptial fertility.—In columns (x.) and (xvi.) of Table LXXIII., p. 242 hereinbefore, the crude and smoothed ratios for ex-nuptial fertility, attributed wholly to the "never married," were given. The crude results are repeated in column (ii.) of Table XCI. hereunder. If attributed to the "unmarried," which includes the widowed and divorced, the results in column (iii.) are obtained, and the corresponding smoothed results are shewn in column (iv.). Reference to the table shews that the maximum fertility is nuptially attained at about the year of age 18.3 to 19.3, and is about 0.484. The maximum fertility is ex-nuptially attained, however, only at about age 21.5 to 22.5, and is about 0.0182; that is to say, the maximum is about 3.2 years later, and the proportion at the maximum is only 0.0376, or say 3/80ths. For all ages from 12 to 57 we have for nuptial-fertility ratio 0.1704, and for the

Nuptial and Ex-nuptial Fertility-ratios.



Curve  ${\bf A}$  denotes the nuptial fertility ratio.

Curve B is the oblique projection of curve A.

Curve C is the ex-nuptial fertility ratio.

ex-nuptial ratio 0.00993. Hence the proportion of the averages is 0.05828. It is obvious that the initial parts of the curves representing the nuptial and exnuptial fertility-ratios are not likely to be identical, because the nuptial denominator for early ages will be small, and the ex-nuptial denominator will be large. Curves A and C, Fig. 87, denote respectively the nuptial and ex-nuptial curves. By the process indicated in § 2, p. 298, the results in columns (vi.) and (vii.) of Table CXI. are obtained; these are shewn in Fig. 87 by curve C; hence the

curves are not in planar correspondence. If, however, the curve A be corrected for the effect of previous births, the two curves come into closer correspondence<sup>1</sup>; that is, ex-nuptial fertility has, in general, nearly the same characteristics as nuptial fertility, excepting that the greater measure of restraint operates to make the maximum occur later, and to enormously reduce the ratio.

<sup>&</sup>lt;sup>1</sup> It is obvious that the ex-nuptial curve does not need the same correction, since oft-repeated ex-nuptial maternity is not likely to occur.

TABLE CXI.—Comparison of Nuptial and Ex-nuptial Fertility-ratios according to Age. Australia 1907 to 1914.

	Ratio of E	x-nuptial	Births to—	Ratio of Nuptial	Ex-nupti	ial Rate
Age of Mother.	the "Never Married."	the" Un	married."	Births to the Married.	Oblique P	rojection.
	Crude.	Crude.	Smoothed.	Smoothed.	Rate.	Age.
(i.)	(ii.)	(iii.)	(iv.)	(v.)	(vi.)	(vii.)
12	.0000	.0000	.0000			
13	.0001	.0001	.0001		• •	
14	.0004	.0004	.0004	.207	.0077	15.4
15	.0016	.0016	.0016	.227	.0085	16.5
16	.0043	.0043	.0043	.301	.0113	18.0
17	.0085	.0085	.0085	.458	.0171	20.1
18	.0131	.0131	.0131	.483	.0181	21.3
19	.0162	.0162	.0158	.479	.0179	22.3
20	.0172	.0172	.0174	.464	.0174	23.2
21	.0181	.0181	.0181	.443	.0166	24.0
22	.0173	.0171	.0181	.416	.0156	24.9
23	.0183	.0182	.0177	.381	.0142	25.7
24	.0176	.0174	.0172	.352	.0132	26.4
25	.0163	.0161	.0163	.333	.0124	27.3
26	.0157	.0154	.0154	.319	.0119	28.1
27	.0147	.0143	.0149	.307	.0115	29.0
28	.0157	.0152	.0145	.293	.0110	30.0
29	.0145	.0139	.0141	.274	.0102	30.9
30	.0157	.0150	.0136	.256	.0096	31.7
31	.0111	.0104	.0131	.241	.0090	32.6
32	.0138	.0128	.0127	.225	.0084	33.5
33	.0131	.0119	.0123	.210	.0079	34.4
34	.0135	.0121	.0119	.197	.0079	35.3
35	.0129	.0113	.0114	.185	.0069	36.3
36	.0127	.0109	.0108	.174	.0065	37.2
37	.0116	.0097	.0101	.164	.0061	38.1
38	.0125	.0101	.0093	.149	.0056	39.0
39	.0103	.0082	.0083	.130	.0049	39.9
40	,0097	.0074	.0070	.108	.0040	40.7
41	.0055	.0041	.0054	.087	.0033	41.6
42	.0060	.0043	.0042	.067	.0025	42.4
43	.0049	.0033	.0030	.050	.0019	43.3
44	.0029	.0019	.0020	.033	.0012	44.2
45	.0021	.0013	.0013	.020	.0007	45.1
46	.0014	.0008	.0008	.010	.0004	46.0
47	.0007	.0004	.0004	.005	.0002	47.0
48	.0005	.0003	.0003	.003	.0001	48
49	.0003	.0002	.0002	.001	.0000	49
50	.0003	.0001	.0001	.001	.0000	50
51	.0001	.0000	.0000	.000	.0000	51

<sup>•</sup> The oblique projection brings the maximum points into arbitrary agreement, the values for the ages indicated also being determined thereby. The rates for these ages are found from those of the nupttal curve by using the projection-ratio.

The difference between the nuptial and ex-nuptial probabilities of confinement are more comprehensively indicated by a decennial table. In Table CXII. hereunder these are given as the number of cases respectively occurring per 10,000 married and per 100,000 "never married" women. The rates, based upon the numbers of the "unmarried," are somewhat smaller.

TABLE CXII.—Shewing the Probabilities of Nuptial and Ex-nuptial Confinement and their Ratio, for Five-Year Age-groups. Australia 1907-1914.

Age Groups.	No. of Married Women at Census 1911.	No. of Cases of Nuptial Confine- ment in 8 Years.	Probab- ility of Matern- ity* during 1 Year.	No. of "Never Married" Women ai Census 1911.	No. of Un- married Women at Census 1911.	No. of Cases of Ex-nup- tial Con- finement	Probab- ility of Matern- ity† during 1 Year.	Probability of Maternity during 1 Year.	ility of e to nuptia	Based upon the Un-
11-14 15-19 20-24 25-29 30-34 35-39 40-44 45-40 50-54 55-60	19 8,637 65,506 109,832 112,532 104,825 94,917 82,263 60,939 38,905	34 33,245 208,667 267,886 204,093 134,481 53,143 5,280 60 4	2,226 4,791 3,962 3,036 2,257 1,597 697 80 1.2 .12	168,778 214,875 152,967 78,036 44,341 29,953 21,483 15,006 9,734 5,698	168,778 214,905 153,514 79,918 47,903 35,888 30,325 27,172 23,463 20,063	152 14,889 21,695 9,696 4,822 2,909 1,040 131 7	11 862 1,765 1,546 1,353 1,208 602 108 9	11 862 1,759 1,510 1,253 1,009 427 60 3 0	.0005 .0180 .0445 .0509 .0600 .0757 .0865 .136 .73	.0005 .0180 .0444 .0497 .0555 .0632 .0613 .075 .025

<sup>\*</sup> Probability per annum per 10,000 married women of same age-group.
† Probability per annum per 100,000 "never married" women of same age-group.

Theory of fertility, sterility and fecundity.—The fertility-ratio or probability of maternity in a unit of time may be defined as the proportion of cases, which, subjected to a given degree of risk for a unit of time, result in maternity; and similarly, the sterility ratio or probability of maternity is the arithmetical complement of the probability; or calling these respectively p and q, p+q=1. If instead of "a unit of time," we write "various given periods of time," we arrive at the conception of a varying degree of fertility or sterility, which for brevity, we may call the fertility, q, or the sterility, s. That is to say, instead of making a sharp qualitative cleavage between the fertile and the infertile or sterile, both are to be regarded as varying quantitatively. Any compilation shewing the frequency of cases of maternity according to duration of marriage reveals the propriety of this mode of envisaging the question. But we have seen that fertility decreases after a certain age, hence age must also be taken into account. Further, the "degree of risk" varies with the age of the husband. Hence, if x denote the age of the wife, y that of the husband, i the duration of the risk, we have :—

$$(558)...g = f(x, y, i); \text{ and } s = 1 - q$$

Fertility and sterility in the sense indicated are determined by the question of a single case of maternity. If instead of this we substitute "result in n cases of maternity," or "result in the bearing of n' children," we arrive at the quantitative conception of fecundity. It is not unlikely that the "degree of risk" varies with the number of previous births. If so, we must write (x, y, i, n) in this last equation.

If the total number of married women of age x be denoted by xM, the duration of their marriage be denoted by a suffix i, the number of nulliparæ, primiparæ, and multiparæ up to n by the suffixes  $1, 2, \ldots n$ , then we can have compilations of the types

$$(559)\ldots xM = xM_0 + xM_1 + \ldots xM_i$$

$$(560)...._x M = {}_xM'_0 + {}_xM'_1 + ...._xM'_n$$

that is, compilation according to age and duration of marriage, or according to age and "issue." It is at once evident that an exhaustive compilation according to x, y, i and n is out of the question, since the individual numbers in each "parcel" would be too small. Hence, serviceable tables must ignore some of the factors.

In some countries fertility probably varies but slightly with the age of the husband, and in all the distribution according to the age probably does not materially vary. Hence, by ignoring the issue, tables of "fertility and sterility" and of "fecundity" may take the following forms, the partial tables serving all general practical purposes:—

Tables of Fertility and Sterility (effect of " Previous Issue" being Ignored).

Arguments of complete tables.	Argument of partial tables.
(i.) Age of wife, with (ii.) age of husband. (iii.) Duration of marriage.	<ul><li>(i.) Age of wife only (i.e., with husbands of all ages).</li><li>(ii.) Duration of marriage.</li></ul>

The tables themselves should shew, for each combination of age and duration of marriage, the proportion of married women who have borne one child.

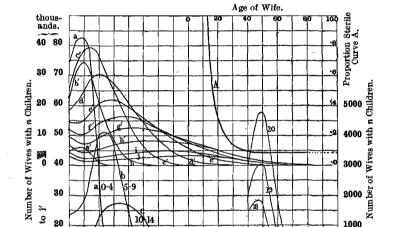
Tables of Fecundity (effect of "Previous Issue" being Ignored).

(i.), (ii.), and (iii.) as above.	(i.) and (ii.) as above.

The tables themselves should shew, for each combination of age and duration of marriage, the proportion of married women who have borne n children, where n is successively 0, 1, 2, 3, 4, etc., etc.

Such tables will need to be for small age-groups (say for single years), and for durations of marriage, which change by small amounts (say one year), inasmuch as the age and duration change together, and the effect of age is considerable.

19. Past fecundity of an existing population.—The past fecundity of any population as at a particular moment is given by a census, both according to "duration of existing marriage" and according to "age." The usual tabulation according to existing marriage ignores the fact that the record is incomplete, and that for deduction purposes a previous marriage may to some extent modify the fecundity. The results in Tables CXIII. and CXIV. hereunder are deduced from the Census tabulations by applying the method outlined in § 4, p. 300, to the crude results. The aggregates for the same "issue" are not, of course, in agreement since in the one case the numbers according to the issue from existing marriages are recorded, and in the other, the numbers according to age include all previous issue.



Curves a

Numbers who bore 1, 2..n Children; also Proportion found to be Sterile.

Curves a to i shew numbers who bore 0 to n children during durations of marriage 0 to 4, 5 to 9, 10 to 14, etc., see Table CXIII.

Number of Children. Fig. 88.

11 12

Curves a' to j' shew the numbers who bore 0 to n shildren according to age and without regard to duration of marriage; curve a' denoting all under 20; surve b' all aged 20 to 24 last birthday; surve o' all aged 25 to 29, etc.; see Table CXIV.

Curves 15 to 20 shew numbers of wives who bore 0 to n children for ages 15 to 20 last birthday; see Table CXIV.

These curves are valid only for integral values of the abscissa (number of children).

Curve A shews the proportion of wives according to age, but of all durations of marriage, who proved sterile.

Table CXIII.—Shewing Issue of 1,000,000 Wives according to Duration of Existing

Duration Existing	Numbei	R OF WI	VES WHO	HAD G	IVEN BIE	ктн то	CHILDRE	н то ти	e Numb	er of—
Marriage.	0.	1.	2.	3.	4.	5.	6.	7.	8.	. 9.
Under 5 years 5-9 years 10-14 ,, 15-19 ,, 20-24 ,, 25-29 ,,	73,765 23,504 16,031 9,586 7,374 5,082	82,436 28,564 15,059 8,821 6,465 3,806	37,904 50,165 22,961 13,150 9,714 5,450	5,874 47,058 27,141 15,427 12,603 7,701	469 24,421 26,897 16,200 13,916 9,413	23 7,800 22,421 14,542 13,276 10,078	1,776 13,774 13,072 12,066 10,095	344 6,325 10,191 10,253 9,162		7 718 8,767 6,602 6,656
30-34 ,, 35-39 ,, 40-44 ,, 45 and over	2,947 1,904 1,055 970	2,036 1,212 600 585	2,669 1,436 778 606	3,566 1,921 948 821	4,684 2,600 1,206 1,094	5,581 3,080 1,582 1,513	5,977 3,478 2,024 1,88 <b>3</b>	6,336 3,864 2,330 2,374	6,228 4,354 2,511 2,859	5,734 4,101 2,618 3,057
Totals for existing marriage	142,218	149,584	144,833	123,055	100,900	79,896	64,145	51,179	41,492	33,260
Total per million for all ages	123,995	146,153	145,107	124,239	103,088	82,140	67,029	53,803	44,026	35,392

\*This does not include children by previous marriage, or ex-nuptial children; it shews the relative frequency of issues of a given number according to "duration of marriage." † The actual total number of wives was 733,773, of which 3747 gave no information either as to duration of marriage or as to number of children; 12,073 gave no information as to number of children, but stated their age; and 21,151 gave no information as to age, but stated the number of children. The 3747 were distributed proportionately to the partially specified totals, the two parts being 1362

Table CXIV.—Shewing Issue of 1,000,000 Wives according to Age, at

Age of	N	UMBER O	F WIVES	з то wно	M HAD I	BEEN BO	RN CHIL	DREN TO	THE N	UMBER, (	OF—
Age of Wives.	0	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
13 14 15 16 17	1 18 92 249 679	0 7 34 207 701	0 0 14 61	  0 5,		:: <sub>o</sub>	::	::	::		
18 19 20 21-24 25-29	1,445 2,086 2,987 19,474 25,137	1,723 3,002 4,751 29,692 38,540	296 747 1,765 19,135 36,232	19 123 320 7,862 24,981	22 2,215 14,161	0 3 439 6,352	0 0 0 106 2,357	16 749	  4 215	  0 53	  0 7
30-34 35-39 40-44 45-49 50-54	18,429 14,383 12,037 9,516 6,688	25,026 15,159 10,458 7,165 4,240	30,571 20,990 14,208 9,519 5,378	27,374 21,917 16,019 11,466 6,848	21,064 19,799 16,525 12,622 7,850	14,291 16,043 14,677 11,945 8,276	8,631 12,429 12,635 11,484 8,145	4,645 8,728 10,073 9,762 7,926	2,082 5,785 7,847 8,327 7,351	836 3,558 5,985 6,749 6,484	284 1,945 4,208 5,223 5,343
55-59 60-64 65-69 70-74 75-79	4,171 2,938 1,913 1,057 474	2,377 1,408 861 503 214	2,755 1,601 928 503 296	3,336 1,803 1,107 651 269	3,991 2,340 1,307 723 314	4,408 2,583 1,608 891 424	4,599 2,955 1,941 1,005 512	4,811 3,113 2,101 1,169 484	4,882 3,290 2,285 1,168 562	4,427 3,106 2,116 1,294 584	4,083 2,953 2,175 1,239 587
80-84 85-89 90-94 95-99 100-104	164 46 10 1 0	61 12 12 0 0	86 12 9 0 1	110 22 7 0 0	113 27 6 0 0	149 49 6 0	182 39 9 0	181 36 9 0	171 49 7 1 0	167 28 4 1 0	155 38 6 0
Totals	123,995	146,153	145,107	124,239	103,088	82,140	67,029	53,803	44,026	35,392	28,246
Totals per million for existing mar- riages	142 218	140 584	144,833	122 055	100 900	70 896	64,145	51,179	41,492	33,260	26,328

The actual total number of wives was 733,773, of which 343 gave no information as to age, or as to number of children; 15,477 gave no information as to number of children, but stated their age; 5432 gave no information as to age, but stated the number of children. The 343 were divided into two groups, viz., 254 and 89, these being distributed proportionately among the partially specified totals. The total additions thus become for the several ages and age-groups: 0, 0, 0, 5, 11, 28, 70, 167, 1228,

Marriage\* at Census of 3rd April, 1911, Australia (Based upon 783,773 Wives.)†

	N	umber oi	WIVES	<b>wн</b> о наг	O HAD GIVEN BIRTH TO CHILDREN TO THE NUMBER OF-										
10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	and over.	Totals.			
1 175 1,741 4,530 5,172	63 726 2,364 3,455	10 277 1,295 2,145	6 99 606 1,199	29 250 592	  9 115 282	  1 39 157	   10 50	   6 18	   	    6		200,471 183,722 153,846 114,452 109,821 88,571			
4,845 3,722 2,675 3,467	3,313 2,789 2,077 2,676	2,223 2,211 1,560 2,319	1,301 1,237 978 1,433	668 672 514 788	317 319 287 421	145 171 141 202	67 67 59 88	29 29 23 44	23 4 23	4 9 1 1	6 14 10 22	58,677 39,213 23,981 27,246			
26,328	17,463	12,040	6,859	3,513	1,750	856	341	149	59	22	58	1,000,000			
28,246	18,826	13,035	7,488	3,834	1,927	941	379	182	68	36	66	1,000,000			

and 2385. The increased numbers thus become :—For Age-groups as indicated in table, 3358, 2903, 2074, 1371, 1210, 943, 591, 439, 230, 316: in all 13,435. For numbers of children as indicated in table, 2796, 2569, 2816, 2614, 2373, 2142, 1828, 1521, 1298, 1076, 876, 604, 493, 288, 125, 62, 24, 17, 6, 2, 1, and 5; in all 23,536. These aggregates of unspecified and partially specified were then distributed proportionately to the original numbers, see Vol. III., p. 1140-1, Census Report.

Census of 3rd April, 1911, Australia. (Based upon 733,773 Wives.)

Nu	MBER OF	WIVES T	о мном	HAD BEE	n Born	CHILDRI	N TO TH	e Numb	er of—	-	
11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	and over.	Totals.
::		::	::		::	:::	·· ·· ··	::	<b>∂</b>		1 25 126 470 1,446
  0 5	  0 3	  		  0	:: :: <sub>o</sub>	::	•••	•••	, . 	 	3,485 5,966 9,848 78,943 148,792
97 907 2,437 3,458 3,699	31 380 1,443 2,241 2,611	7 160 766 1,287 1,482	3 67 328 685 754	3 16 178 327 356	1 78 156 196	0 1 20 73 67	0 13 26 33	 0 8 8	0 1 8 8	0 3 5 13	153,375 142,270 129,939 112,052 83,756
3,021 2,205 1,592 904 357	2,166 1,759 1,305 656 347	1,313 1,000 762 463 194	669 548 410 238 105	335 298 236 114 53	171 144 113 58 14	74 70 51 13 4	36 33 21 13	$\begin{array}{c} 21 \\ 6 \\ 11 \\ 8 \\ 6 \end{array}$	7 7 4 	8 12 8 11 1	51,656 34,172 22,855 12,681 5,809
$\begin{array}{c} 116 \\ 24 \\ 4 \\ 0 \\ 0 \\ \end{array}$	76 16 1 0 0	47 6 1 0 0	22 4 0 1 0	10 1 0 0	3 	6 0  		::	·· ·· ··	3 1 1 0 	1,823 413 92 4 1
18,826	13,035	7,488	3,834	1,927	941	379	182	68	36	66	1,000,000
17,463	12,040	6,859	3,513	1,750	856	341	149	59	22	58	1,000,000

2252, 2203, 2071, 1993, 1677, 1431, 888, 648, 476, 316, 157, 81, 23, 4, 0, 2; in all, 15, 731; and for the numbers of children as indicated in the table, 591, 717, 730, 693, 602, 490, 415, 309, 277, 218, 181, 128, 76, 51, 18, 12, 7, 2, 3, 0, 0, 1; in all 5521. These aggregates for the unspecified, together with the partially-specified, were then distributed proportionately to the original numbers; see Vol. VIII. Census Report, pp. 1366-7.

The results given in Table CXIII. are shewn by curves (a) to (i) in Fig. 88; and those in Table CXIV. are shewn by the curves (a) to (j') in the same figure, the single year results of the latter table being marked 15, 16, . . . . 20. Interpolated curves would give the results for any other 5-year age or duration ranges.<sup>1</sup>

The curves of frequency of cases, according to number of issue, for the 5-year, or for the single-year age-groups, are of the same type, and are essentially dimorphic: strictly they give values only for integral values of the variable.<sup>2</sup> Thus they could no doubt be fairly well represented by curves of the type:—

$$(561)....y = Ae^{-ax} + Bx^{b+ex}$$

in which x has the values  $0, 1, 2, 3, \ldots$  etc.

Fecundity during a given year.—A different type of compilation is necessary to reveal what may be called the "existing fecundity." existing nuptial fecundity is shewn by the number of married women in each age-group, the number who failed to bear a child during the year, and the number who bore the nth child where  $n = 1, 2, 3, \ldots$  etc. This is deduced from two sources, viz., (i.) from the Census record for the numbers of married women; and (ii.) from the records of one year or for a series of years (1908-1914). The grand total of those who bore a child during the whole period of 7 years, i vided by 7.0666; gave a result substantially identical with that for the ear 1911, which may be regarded as satisfactory.3 This is seen from the close agreement of the numbers in the two upper portions of Table CXV. It is evident, therefore, that the vital statistics results for the Census year represent fairly satisfactorily the general case, and a 3 or 5-year result with the Census year as middle year would ordinarily be quite satisfactory.

<sup>&</sup>lt;sup>1</sup> It is clearly desirable that Census results should be compiled for single years, as soon as public appreciation of the value of a correct statement of age leads to accuracy.

<sup>&</sup>lt;sup>2</sup> Statistical results furnish a number of examples of this character: for example the numbers of families living in houses with  $1, 2, 3, \ldots n$  rooms, etc.

<sup>&</sup>lt;sup>3</sup> If the rate of change of the proportion married be supposed linear, the married female population at the Census is to the aggregate of married females as 1: 7.1272. The ratio of the number of brides is 1: 6.9473. The ratio of females is 1: 7.1077, and of population 1: 7.1150. It is obvious, therefore, that the ratio 7.0666 is very nearly correct.

TABLE CXV.—Shewing for various Age-groups and for all Durations of Marriage the Number who, during the year, bore the nth Child, where n=0 to 10; and the Total of those who bore a Child later than the 10th. Australia, 1911 and 1908-1914.

Age of	Total	who Child ing	or who he he he he he he he he he he he he he		Number for which the Child Born was the—												
Mothers	Married Women	No. v Bore a duri the Ye	No. Bore Child of the	1st	2nd	3rd	4th	5th	Later than 5th.	6th	7th	8th	9th	10th	Later than 10th.	not Speci- fled.	
-19 20-24 25-29 30-34 35-40 40-44 45-	8,716 65,959 110,591 113,310 105,550 95,573 82,933	25,957 33,817 25,682 16,839 6,763	40,002 76,774 87,628 88,711	13,039 9,271 3,632 1,279 303	7,717 8,672 4,327 1,539	53 3,642 7,109 4,522 1,997 405 29	1,085 4,727 4,328 2,277 531 36	0 246 2,419 3,501 2,243 722 40			0 8 336 1,565 1,848 777 64	0 4 86 745 1,383 771 70	0 29 317 970 706 72	131 591 607		28 7	
Totals	582,632	113,917	468,715	31,000	23,214	17,757	12,988	9,171	19,474	6,601	4,598	3,059	2,094	1,423	1,699	313	

### NUMBERS CORRESPONDING TO THE ABOVE BASED UPON THE TOTALS FOR THE PERIOD 1908-1914.

-19 20-24 25-29 30-34 35-40 40-44 45-	*8,716 65,959 110,591 113,310 105,550 95,573 82,933	\$4,156 26,277 33,831 25,639 16,742 6,609 663	39,682 76,760 87,671 88,808 88,964	13,248 9,317 3,592 1,259 288		66 3,578 7,065 4,624 1,963 418 21	1,102 4,748 4,281 2,274 547	0 <b>£246</b> 2,468 3,504 2,293 666	$1,530 \\ 5,321$	2,523 2,130 717	1,529	1,416 749	0 0 29 326 968 677 76	0 0 8 123 580 579	504 910	
Totals			468,715		23,560	17,735					4,558	3,090	2,076	1,364		

## Proportions to Totals of Same age; 1911 Results.

-19 100,000 47,568 20-24 100,000 39,353 25-29 100,000 22,665 35-40 100,000 22,665 40-44 100,000 7,076 45- 100,000 860	69,421 8,384 7,842 77,335 3,205 3,819 84,047 1,212 1,458	5,522 1,645 6,428 4,274 3,991 3,820	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	70 12 6 776 12 988 304 F 78 2,230 1,381 657 774 813 807 58 77 84	3 26 7 7 280 116 9 919 560 7 739 635	0 161 6 251 2 59 50 26 513 26 918 7 266 4
--------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------	-------------------------------------------	---------------------------------------	------------------------------------------------------------------	-----------------------------------------------	-------------------------------------------------------------

### PROPORTIONS TO TOTALS OF SAME AGE; BASED UPON THE TOTALS FOR THE PERIOD 1908-1914.

						`								
-19 20-24 25-29 30-34 35-39 40-44 45-	100,000 100,000 100,000 100,000 100,000 100,000	47,682 39,838 30,591 22,627 15,862 6,915 799	39,123 20,085 8,425 3,170 1,193 302 27	757 5,425 6,388 4,081 1,860 437 25	46 1,670 4,293 3,778 2,154 572 40	0 373 2,232 3,092 2,172 697 43	0 91 1,383 4,696 7,071 4,581 641	2,226 2,018 750	0 15 315 1,349 1,767 781 72	1,342	0 26 288 917 708 92	0 7 109 550 606 89	0 0 3 56 477 952 252	

<sup>\*</sup> Adjusted numbers, see Census Report, Vol. II., p. 19, and also Vol. III., pp. 1136-7. The numbers given are the Census numbers adjusted and multiplied by a factor to make them agree with the mean female population of the year. † In cases where a woman bore twice in the same year, she has been counted twice. The results in this column are obtained from the vital statistics of the year 1911. † The actual figures throughout have been multiplied by a factor (viz., 0.141509 = 1÷7.0666), so as to make this total, 113,917, to agree with the total above; hence, if the distribution for 1911 were identical with that of the seven-year period 1908-1914, the figures in the several columns would be identical. They are approximately so. § The whole of the numbers in the column are those for 1908-1914, multiplied by 0.141509. || These numbers are obtained by subtracting the totals of those who bore children from the total number of married women.

TABLE CXVI.—Shewing the Number of Married Women at each Age, the Number of Cases of Maternity, and the Number for all Durations of Marriage, who had not given Birth to a Child. Australia 1907-1914.

(i.) (ii.) (iii.) (iii.) (iv.) (v.) (vi.) (vii.) (i.) (i.) (i.) 13 1 1 1 0.5 1 1 1 1 0.000 1.0000 1 1 1 0.5 1 1 2 7.7222 8140 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
(i.) (ii.) (iii.) (iii.) (iv.) (v.) (vi.) (vii.) (i.) (i.) (i.) 13 1 1 1 0.5 1 1 1 1 0.000 1.0000 1 1 1 0.5 1 1 2 7.7222 8140 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Wives 1911 7en Bi Childr	No. of Married Vomen	Propo Mar Wome had no Birtl	rtion of ried en who ot given n to a aild.
13         1         0.5         1         1*1.0000         1.0000                                                                                                  <	No. o Censu had g	1911.	Crude.	Smooth-
14         18         3.7         13         2         7.7222         8.140 <td>(iv.)</td> <td>(ii.)</td> <td>(vi.)</td> <td>(vii.)</td>	(iv.)	(ii.)	(vi.)	(vii.)
15         96         21.2         67         3         7.204         .6530         55         9,468           16         349         141.9         183         4         .5244         .5330         56         8,557           17         1,145         494.7         498         5         .4349         .4450         57         .7,675           18         2,551         1,219         1,061         6         .4159         .3820         58         6,913           20         6,933         3,150         2,192         8         .3162         .3075         60         5,746           21         10,100         4,423         2,772         9         .2744         .2815         61         5,277           22         18,047         5,428         3,422         10         .2622         .2856         63         4,505           24         18,905         6,669         4,123         12         .2181         .2165         64         4,161           25         20,683         6,811         4,123         12         .2181         .2186         64         4,161           22,180         6,751         3,678         15		t.	::	
16         849         141.9         183         4         5244         5330         56         8,557         7,675           17         1,145         494.7         1,061         6         .4159         .3820         58         6,912           19         4,499         2,261         1,531         7         .3403         .3403         59         6,293           20         6,933         3,150         2,192         8         .3162         .3075         60         5,748           21         10,100         4,423         2,772         9         .2744         .2815         61         5,277           22         18,047         5,428         3,422         10         .2622         .2850         62         4,871           23         16,521         6,306         3,973         11         .2405         .2365         63         4,505           24         18,905         6,699         4,123         12         .2181         .2165         64         4,161           25         20,683         6,811         4,123         13*         1,993         1,990         65         3,829           26         21,620         6,903 <td>769</td> <td>0 168</td> <td> </td> <td>.0817</td>	769	0 168		.0817
17         1,145         494.7         498         5         4,349         3450         57         7,675           18         2,561         1,219         1,531         7         3,403         3,403         59         6,912           19         4,499         2,261         1,531         7         3,403         3,403         59         6,993           20         6,933         3,150         2,102         8         3,162         3,075         60         5,746           21         10,100         4,423         2,772         9         2,2744         2,815         61         5,277           22         18,047         5,428         3,422         10         2602         2580         62         4,871           23         16,521         6,306         3,973         11         2,405         2,365         63         4,505           24         18,905         6,669         4,123         12         2,181         2,2165         63         4,505           25         20,683         6,811         4,123         13*         1,990         65         3,829           26         21,620         6,903         3,688         14 <td>678</td> <td>8,557</td> <td>  ::</td> <td>.0815</td>	678	8,557	::	.0815
20         6,983         3,150         2,192         8         3,162         2,277         2         9         2,744         2,815         61         5,277         22         18,047         5,428         3,422         10         2,622         2,2580         62         4,871         23         16,521         6,306         3,973         11         2,405         2,2865         63         4,505         24         18,905         6,689         4,123         12         2,2181         .2165         64         4,161         24,560         25         20,683         6,811         4,123         13*         1,993         1,990         65         3,829         26         21,620         6,903         3,968         14         1,831         1,890         65         3,829         227         22,180         6,751         3,678         15         1,658         1,670         67         3,194         28         22,765         6,192         3,238         17         1,422         1,424         68         2,880         29         22,765         6,192         3,238         17         1,422         1,424         69         2,621         16,026         31         22,728         6,042         3,034         18* <td>581</td> <td>7 675</td> <td>1</td> <td>.0814</td>	581	7 675	1	.0814
20         6,983         3,150         2,192         8         3,162         2,277         2         9         2,744         2,815         61         5,277         22         18,047         5,428         3,422         10         2,622         2,2580         62         4,871         23         16,521         6,306         3,973         11         2,405         2,2865         63         4,505         24         18,905         6,689         4,123         12         2,2181         .2165         64         4,161         24,560         25         20,683         6,811         4,123         13*         1,993         1,990         65         3,829         26         21,620         6,903         3,968         14         1,831         1,890         65         3,829         227         22,180         6,751         3,678         15         1,658         1,670         67         3,194         28         22,765         6,192         3,238         17         1,422         1,424         68         2,880         29         22,765         6,192         3,238         17         1,422         1,424         69         2,621         16,026         31         22,728         6,042         3,034         18* <td>531</td> <td>6,912</td> <td></td> <td>.0813</td>	531	6,912		.0813
20	501	6,293	.0786	.0814
21         10,100         4,423         2,772         9         2,2744         2,815         61         5,277           22         18,047         5,428         3,492         10         2,622         2,580         62         4,871           23         16,521         6,306         3,973         11         2,405         2,365         63         4,505           24         18,905         6,669         4,123         12         2,218         2,606         4,460           25         20,683         6,811         4,123         13*         1,990         65         3,829           26         21,620         6,903         3,968         14         1831         1,825         66         3,502           27         22,180         6,751         3,678         15         1,658         1,670         67         3,194           28         22,684         6,691         3,448         16         1,527         1,524         68         2,889           30         22,784         6,042         3,034         18*         1,332         1,339         70         2,365           31         22,726         5,065         2,849         19	3,060 479	5.746	1	.0815
22         18,047         5,428         3,422         10         2622         2,2580         62         4,871           23         16,621         6,306         3,973         11         2405         2365         63         4,460           24         18,906         6,609         4,123         12         2181         .2165          24,560           25         20,683         6,811         4,123         13*         1993         1990         65         3,829           26         21,620         6,903         3,958         14         1,831         1,890         65         3,829           27         22,180         6,751         3,678         15         1,658         1,670         67         3,194           28         22,766         6,192         3,238         17         1,422         1,424         69         2,621           108,832         38,348         18,445          1,679          16,026           31         22,726         6,062         3,034         18*         1332         1339         70         2,365           31         22,726         5,065         2,849         19	458	5.277	::	.0816
23         16,521         6,306         3,973         11         2405         2365         63         4,161           65,506         25,976         16,482          25,185           24,560           25         20,683         6,811         4123         13* 1993         1990         65         3,502           26         21,620         6,903         3,958         14         1831         1825         66         3,502           27         22,180         6,751         3,678         15         .1658         .1670         67         3,194           28         22,584         6,691         3,488         18         1.527         .1524         68         2,880           29         22,765         6,192         3,238         17         .1422         .1424         69         2,621           109,832         33,348         18,445          .1679           16,026           31         22,726         5,065         2,849         19         1254         1266         71         2,365           31         22,542         5,240         2,684         21         .109 <td>l 435</td> <td>4,871</td> <td></td> <td>.0820</td>	l 435	4,871		.0820
66,566         25,976         16,482          25,18          24,560         25,3820           26         20,683         6,811         4,123         13* 1993         1.990         65         3,829           26         21,620         6,903         3,958         14         1.831         1.825         66         3,502           27         22,180         6,751         3,678         15         1.1658         1.670         67         3,194           28         22,584         6,691         3,448         16         1.527         1.524         68         2,880           29         22,766         6,192         3,238         17         1.422         1.424         69         2,621           30         22,784         6,042         3,034         18*         1.332         1399         70         2,365           31         22,726         5,065         2,849         19         1.254         1.266         71         2,099           32         22,542         5,240         2.621         1.133         1.147         73         1,667           33         22,421         4,722         2,540         21			••	.0823
25         20,683         6,811         4,123         13* 1.993         1.990         65         3,502           27         22,180         6,751         3,678         14         1.831         1.825         66         3,502           27         22,180         6,751         3,678         15         1.1658         1.670         67         3,194           28         22,584         6,691         3,448         16         1.527         1.524         68         2,880           29         22,765         6,192         3,238         17         1.422         1.424         69         2,621           108,832         33,348         18,445         .         .         1.6026         .         .         16,026         .         .         16,026         .         .         16,026         .         .         .         16,026         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .	382 <b>2,166</b>	94,101	.0882	.0827
26         21,620         6,903         3,968         14         1.831         1.825         66         3,502           27         22,180         6,751         3,678         15         1.658         1.670         67         3,194           28         22,5765         6,192         3,288         17         1.1422         1.124         69         2,820           108,832         33,348         18,445         1.1679         1.1606         71         2,969           30         22,784         6,042         3,034         18*         1.332         1399         70         2,366           31         22,726         5,065         2,849         19         1.254         1.266         71         2,099           32         22,542         5,240         2,684         20         1.191         1.203         72         1,867           33         22,421         4,722         2,540         21         1.133         1.147         73         1,652           34         22,059         4,338         2,416         22         1.095         1.101         74         1,444           112,532         25,407         13,553         .         12	353	3.829	.0802	.0837
28         22,584         6,691         3,448         16         1.527         1.524         68         2,820           108,832         33,348         18,445         .         .         16,792         .         .         16,022         .         .         16,028         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .	319	3,502	::	.0842
22, 24, 65   6,192   3,288   17   1,422   1,424   69   16,026     30   22,784   6,042   3,034   18*   1,332   1399   70   2,365     31   22,726   5,065   2,849   19   1,254   1,266   71   2,099     32   22,542   5,240   2,684   20   1,191   1,203   72   1,867     33   22,421   4,722   2,540   21   1,1138   1,147   73   1,652     34   22,059   4,338   2,416   22   1,095   1,101   74   1,444     112,532   25,407   13,523     1,202       9,427     36   21,700   3,958   2,299   23   1,059   1,062   75   1,224     36   21,350   3,721   2,195   24   1,028   1,029   76   1,004     37   21,000   3,118   2,101   25   1,000   1,000   77   818     38   20,560   3,118   2,017   26   0,081   0,979   78   650     39   20,215   2,629   1,942   27   0,961   0,959   79   510     104,825   16,741   10,564     1,007     4,206     40   19,851   2,148   1,880   28   0,947   0,942   80   397     41   19,457   1,548   1,823   29   0,936   0,927   81   317     42   19,026   1,386   1,766   30   0,928   0,913   82   241     43   18,543   939   1,710   31   0,022   0,900   83   184     44   18,040   595   1,653   32   0,916   0,888   84   140     94,917   6,616   8,832     0,930   0,888   86   80     47   16,554   346   1,767   33   0,898   0,877   85   105     46   17,064   174.2   1,494   34   0,876   0,868   86   80     47   16,554   346   1,577   33   0,898   0,877   85   105     48   16,975   38,7   1,306   36   0,817   0,852   88   35     49   16,516   13,2   1,203   37   0,791   0,845   89   24     48   16,975   38,7   1,306   36   0,817   0,845   89   24     49   15,216   13,2   1,203   37   0,791   0,845   89   20   20     50   14,303   4.2   1,116   38   0,780   0,837   90   20   20   16   16   16   16   15   1,049   39   0,797   0,832   91   16	l 283	3,194		.0848
109,832   33,348   18,445     .1679     16,026   31   22,726   5,065   2,849   19   1.254   1.266   71   2,099   32   22,542   5,240   2,684   20   1.191   1.203   72   1,867   33   22,421   4,722   2,540   21   1.133   1.147   73   1,652   34   22,059   4,338   2,416   22   1.095   1.101   74   1,444   112,532   25,407   13,523     1.202	247	2,880		.0854
30         22,784         6,042         3,034         18* 1.332         1.399         70         2,365           31         22,726         5,065         2,849         19         1.254         1.266         71         2,099           32         22,542         5,240         2,684         20         1.191         1.203         72         1,867           33         22,421         4,722         2,540         21         1.133         1.147         73         1,652           34         22,059         4,338         2,416         22         1.095         1.101         74         1,444           112,532         25,407         13,523         .         1.202         .         .         9,427           36         21,700         3,958         2,299         23         1.059         1.062         75         1,224           36         21,350         3,721         2,195         24         1.028         1.029         76         1,004           37         21,000         3,118         2,017         26         .0981         .0970         78         818           38         20,215         2,629         1,942         27	l 211 <b>3 1,413</b>	10,021	.0882	.0861
31         22,728         5,065         2,849         19         1.254         1.266         71         2,096           32         22,542         2,684         20         1.191         1.203         72         1,867           33         22,421         4,722         2,540         21         1.133         1.147         73         1,652           34         22,059         4,338         2,416         22         1.095         1.101         74         1,444           112,632         25,407         13,523         .         1.202         .         .         9,427           35         21,700         3,958         2,299         23         1.059         1.062         75         1,224           36         21,350         3,721         2,101         25         1.000         1.000         77         818           38         20,560         3,118         2,017         26         .0981         .0979         78         650           39         2,215         2,629         1,942         27         .0961         .0979         78         650           40         19,851         2,148         1,883         29         .094	1,413	2 365		.0868
32         22,542         5,240         2,684         20         1.191         1.203         72         1,867           34         22,421         4,722         2,540         21         1.133         11147         73         1,652           34         22,699         4,338         2,416         22         1.095         .1101         74         1,462           35         21,700         3,958         2,299         23         1.059         1.062         75         1,224           36         21,350         3,721         2,195         24         1.028         1.029         76         1,004           37         21,000         3,315         2,101         25         1.000         1.000         77         818           38         20,560         3,118         2,017         26         .0981         .0979         78         650           39         2,215         2,629         1,942         27         .0961         .0959         79         510           40         19,851         2,148         1,880         28         .0947         .0942         80         397           42         19,026         1,386         1,7	168	2,099	::	.0876
34         22,059         4,338         2,416         22         1.095         1.101         74         1,444           112,532         25,407         13,523          1.202           9,427           36         21,350         3,721         2,195         24         1.028         1.029         76         1,004           37         21,000         3,315         2,101         25         1.000         1.000         77         818           38         20,560         3,118         2,017         26         .0981         .0979         78         650           39         20,215         2,629         1,942         27         .0961         .0959         79         510           104,825         16,741         10,554          1.007          4,206           40         19,851         2,148         1,880         28         .0947         .0942         80         397           41         19,457         1,548         1,823         29         .0936         .0927         81         317           42         19,026         1,386         1,766         30         .0928	7 146	1,867	::	.0885
112,532   25,407   13,523     .1202     .1202     .75   1,224   .36   .21,350   3,721   .2,195   .24   .1028   .1029   .76   1,004   .37   .21,000   .3,315   .2,101   .25   .1000   .1000   .77   .818   .38   .20,560   .3,118   .2,101   .26   .0981   .0979   .78   .650   .39   .20,215   .2,629   .1,942   .27   .0961   .0959   .79   .510   .104,825   .16,741   .10,554     .1007       .4,206   .40   .19,851   .2,148   .1,880   .28   .0947   .0942   .80   .397   .41   .19,457   .1,548   .1,823   .29   .0936   .0927   .81   .317   .42   .19,026   .1,386   .1,766   .30   .0928   .0913   .82   .241   .43   .18,543   .939   .1,710   .31   .0922   .0900   .83   .184   .44   .18,040   .595   .1,653   .32   .0916   .0888   .84   .140   .94,917   .6,616   .8,82     .0930       .1,279   .45   .17,554   .46   .17,554   .46   .17,554   .46   .17,554     .386   .1,577   .33   .0898   .0877   .85   .105   .47   .47   .42   .494   .44   .0876   .0868   .86   .80   .47   .16,554   .85.6   .1,494   .34   .0876   .0868   .86   .80   .80   .47   .0860   .87   .56   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .85   .8		1,652		.0896
35         21,700         3,958         2,299         23         1.059         1.062         75         1,224           36         21,350         3,721         2,195         24         1.028         1.029         76         1,004           37         21,000         3,315         2,101         25         1.000         1.000         77         818           38         20,560         3,118         2,017         26         .0981         .0979         78         650           39         20,215         2,629         1,942         27         .0961         .0959         79         510           40         19,851         2,148         1,880         28         .0947         .0942         80         397           41         19,457         1,548         1,823         29         .0936         .0927         81         317           42         19,026         1,386         1,766         30         .0928         .0913         82         241           43         18,543         939         1,710         31         .0922         .0900         83         184           44         18,040         595         1,653				.0908
36         21,350         3,721         2,195         24         1,028         1,029         76         1,004           37         21,000         3,315         2,101         25         1,000         1,000         77         818           38         20,560         3,118         2,017         26         .0981         .0979         78         650           39         20,215         2,629         1,942         27         .0961         .0959         79         510           40         19,851         2,148         1,880         28         .0947         .0942         80         397           41         19,457         1,548         1,823         29         .0936         .0927         81         317           42         19,026         1,386         1,766         30         .0928         .0913         82         241           43         18,643         939         1,710         31         .0922         .0900         83         184           44         18,040         595         1,653         32         .0916         .0888         84         140           94,917         6,618         8,832	7 748 1 96	1 224	.0793	.0921
37         21,000         3,315         2,101         25         1,000         1,000         77         818           38         20,560         3,118         2,017         26         .0981         .0979         78         650           39         20,215         2,629         1,942         27         .0961         .0959         79         510           104,825         16,741         10,564          .1007           4,206           40         19,851         2,148         1,880         28         .0947         .0942         80         397           41         19,457         1,548         1,823         29         .0936         .0927         81         317           42         19,026         1,386         1,766         30         .0928         .0913         82         241           43         18,543         939         1,710         31         .0922         .0900         83         184           44         18,040         595         1,653         32         .0916         .0888         84         140           94,917         6,616         8,832          .0930 </td <td>82</td> <td>1,004</td> <td>  ::</td> <td>.0934</td>	82	1,004	::	.0934
38         20,560         3,118         2,017         26         .0981         .0979         78         650           39         20,215         2,629         1,942         27         .0961         .0959         79         510           40         19,851         2,148         1,880         28         .0947         .0942         80         396           41         19,457         1,548         1,823         29         .0936         .0927         81         317           42         19,026         1,386         1,766         30         .0928         .0913         82         241           43         18,543         939         1,710         31         .0922         .0900         83         184           44         18,040         595         1,653         32         .0916         .0888         84         140           94,917         6,616         8,832          .0930          1,279           45         17,554         346         1,577         33         .0898         .0877         85         105           46         17,064         37         1,403         35         .0847	3 70	818	::	1001
104,825				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	48	510	-::-	1 1
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	355 7 38	4,206	.0844	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	7 30	317		
43     18,643     939     1,710     31     .0922     .0900     83     184       44     18,040     595     1,653     32     .0916     .0888     84     140       94,917     6,616     8,832     .     .0930     .     .     1,279       45     17,554     346     1,577     33     .0898     .0876     .0868     86     80       46     17,064     174.2     1,494     34     .0876     .0868     86     80       47     16,554     85.6     1,403     35     .0847     .0860     87     56       48     15,975     38.7     1,306     36     .0817     .0852     88     35       49     15,216     13.2     1,203     37     .0791     .0845     89     24       82,368     657.7     6,983     .     .0848     .     .     300       50     14,303     4.2     1,116     38     .0780     .0837     90     20       51     13,162     1.5     1,049     39     .0797     .0832     91     16	23	241	::	l _
94,917         6,816         8,832          .0930          1,279           45         17,554         346         1,577         33         .0898         .0876         .0868         86         105           46         17,064         174.2         1,404         34         .0876         .0868         86         80           47         16,554         85.6         1,403         35         .0847         .0860         87         56           48         15,975         38.7         1,306         36         .0817         .0852         88         35           49         15,216         13.2         1,203         37         .0791         .0845         89         24           82,363         657.7         6,983          .0848           300           50         14,303         4.2         1,116         38         .0780         .0837         90         20           51         13,162         1.5         1,049         39         .0797         .0832         91         16				i n
45         17,554         346         1,577         33         .0898         .0877         85         105           46         17,064         174.2         1,494         34         .0876         .0868         86         80           47         16,554         85.6         1,403         35         .0847         .0860         87         56           48         15,975         38.7         1,306         36         .0817         .0852         88         35           49         15,216         13.2         1,203         37         .0791         .0845         89         24           82,363         657.7         6,983         .         .0848           300           50         14,303         4.2         1,116         38         .0780         .0837         90         20           51         13,162         1.5         1,049         39         .0797         .0832         91         16				ಡ
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		1,279	.0946	4
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82,363     657.7     6,983      .0848       300       50     14,303     4.2     1,116     38     .0780     .0837     90     20       51     13,162     1.5     1,049     39     .0797     .0832     91     16	5   5	35	::	я
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51   13,162   1.5   1,049   39   .0797   .0832   91   16			1.100	1
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53   11,100   0.6   914   41   .0823   .0823   93   9	) <u> </u>	9	1	
54   10,286   0.1   847   42   .0823   .0819   94   7	<u> </u>	.7	.::-	] ·
60,939 7.3 4,9070805 95-100 21			.0937	<b>)</b>

<sup>\*</sup> Actually extends to about 1 year greater than shewn. † G

21. Number of married women without children, all durations of marriage.—The relative numbers of married women of each age, and for all durations of marriage, who are without children, are readily determinable by means of a Census. That for 1911 gave the results shewn in Table CXVI. above. The smoothed results in column (vii.) of the table are shewn by curve A on Fig. 88. The ratio very rapidly falls to the value of about one-fourth, which is attained during age 22; one-eighth

<sup>†</sup> Graduated.

is reached during age 31; one-tenth during age 37; and the minimum during age 58, which age is, of course, somewhat uncertain. After the age of that minimum the results are very uncertain. Apparently the curve will require several terms of the type  $Ae^{-ax}$  to empirically represent it, thus the ratio being denoted by  $\sigma$ , and the age  $\xi$  being reckoned from say 12 or 13, the ratio will be of the form :—

$$(562).....\sigma = A + Be^{-b\xi} C + e^{-c\xi} + .... + K\xi^{k}$$

22. Sterility-ratios according to age and duration of marriage.—The effect of the age of the husband being ignored, the number of cases of sterility, (or more strictly of childlessness,)<sup>1</sup> according to duration of marriage, for women of different ages in Australia was found from the Census of 1911 to be as shewn in the following table:—

A number of instances are given in the "Handbuch der Medizinischen Statistik," by Friedrich Prinzing, Dr. Med., 1906, Cap. III.; "Die sterilen und kinderlosen Ehen," pp. 30-40.

The following estimations	s of sterility may	be mentioned:*

Authority.	No. of Marriages under Observation.	Elapsed Period after Marriage.	No. of Sterile Cases.	Ratio.
Dresden Returns	27,911	5 years	672	0.02407
Dresden Returns	27,911	10 years & more	134	0.00480
Austerlitz, Prag, 1891-	,			
1900	3,920	Not stated	295	0.0753
Hofmeier	2,220	Not stated	?	0.147
Lier and Ascher	2,500	Not stated	?	0.090
Huizinga (Groningen)	1,180	Not stated	?	0.115
Verrijn Stuart, Nether-				
lands	9,443	16 to 21 years	?	0.131
Do., poorer classes	'?	Not stated	?	†0.141 ±0.110
Do., middle classes	?	Not stated	?	†0.162 to.109
Do., well-to-do classes	?	Not stated	?	10.160 20.126

<sup>†</sup> Town. ‡ Country.

¹ Physiological sterility is the condition, not merely of childlessness, but of childlessness due either to failure to conceive, or to retain the fertilised ovum the full time. The data of ordinary statistics cannot conclusively establish the frequency of physiological sterility, since what is given are merely measures of childlessness.

<sup>\*</sup>Other results are:—Spencer, Wells & Sims (Great Britain), 0.125; Duncan (Glasgow and Edinburgh), 0.163; Ansell, 1919 cases, Married Women, 0.079; A Swedish County, 0.100; Massachusetts, 1885, 0.176; Women over 50, 0.119.

The whole of the above statements are, of course, defective, inasmuch as sterility is a function both of duration of marriage as well as of age, etc.

Table CXVII.—Sterility according to Age and Duration of Existing Marriage. Australia, 3rd April, 1911 (Census).

		<del></del>			AL USUIC	illa, U	u Api								
AGE	Пипе	R 5 YE	A De		DURAT	- 10	OF EXI	STING 15 Yi	4		20 YE	ADG	20 ma	25 YE	
OF WIVES	————	K 5 IE.	ARS.	5 10	, 10 XK	ARS.	10 TC	7 10 11	ARS.	15 10	20 18.	ans.		20 11	
TIME OF CENSUS	Childless Mothers.	Total Mothers.	Sterility Rate.	Childless Mothers.	Total Mothers.	Sterllity Rate.	Childless Mothers.	Total Mothers.	Sterility Rate.	Childless Mothers.	Total Mothers.	Sterility Rate.	Childless Mothers.	Total Mothers.	Sterility Bate.
Under *14 *14 *15 *16 *17 *18 *20 21-24 25-29 30-34 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85-89	1,753 893 431	1 18 92 338 1,044 2,512 4,270 6,693 43,424 45,673 19,739 8,118 3,575 1,869 431 247 140 64 20 3	1.000 .722 .728 .530 .469 .415 .350 .316 .308 .322 .375 .505 .726 .938 .939 1.000 1.000 1.000 1.000	7444 3,998 2,889 2,120 1,712 1,108 5255 74 288 7	16,992 6,731 2,749 1,187 531 255 117	         	2,079 2,693 2,096 1,517 1,089 701 332 173 91 37 111	40,121 32,715 14,568 5,280 1,865 779 332 173 91 37		1 262 1,348 1,723 1,199 806 420 198 100 38 4 2	21 8,594 1,792 24,408 9,253 3,230 1,088 447 199 100 388 4 2	         		21 9,324 32,477 22,780 2,285 791 337 128 553 17 4	
					DUI	CATIO	OFE	XISTI	NG MA	RRIAG	E.				
AGE OF WIVES	25 7	X 30 X	EARS.	30 1	го 35 Ү	EARS.	35 T	o 40 Y	EARS.	40 TO	45 YI	EARS.	OVE	45 YI	ARS.
AT TIME OF CENSUS	Childless Mothers.	Total Mothers.	Sterility Rate.	Childless Mothers.	Total Mothers.	Sterility Rate.	Childless Mothers.	Total Mothers.	Sterility Rate.	Childless Mothers.	Total Mothers.	Sterility Rate.	Childless Mothers.	Total Mothers.	Sterility Bate.
35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85-89 90-94 95-99	221 1,005 955 456 346 292 188 72	4,762 1,590 522 206 72	.913 1.000	165 663 511 284 213 125 68 28	9,574 2,946 978 295 73 23		1 1	6,437 2,120 569 121 26		18 5	305 57 8	 .029 .032 .055 .088 .151 .316 .625	59 214 221 116 46 14	6,630 5,660 2,994 945 200	

\* The results are from Census Report III., p. 1136. The general results are obtained from an unpublished series of compilations according to age-groups, and duration-of-marriage groups. In neither case were the "unspecified" distributed; such distribution, however, can affect the results only very slightly.

An examination of the results given in the table shews that initially the sterility-ratio decreases; it attains a minimum, and then increases; see particularly the duration of marriage 0 to 4 years (i.e., under 5 years). The initial fall may be regarded as the normal decrease of childlessness with increase of the duration of the risk. From the minimum onward, however, the curve shews the true measure of sterility for a given duration of marriage, and for any age terminating the given duration of marriage.

The curves on Fig. 89 are the sterility-ratios according to age, each curve denoting a separate range of duration of marriage. By projection Fig. 90, shewing the curves of equal sterility, is derived. From these, the correlative durations of marriage and ages, corresponding to any degree of sterility, can be at once seen. The dots give the positions as determined from the data, the curves throughout are smoothed.

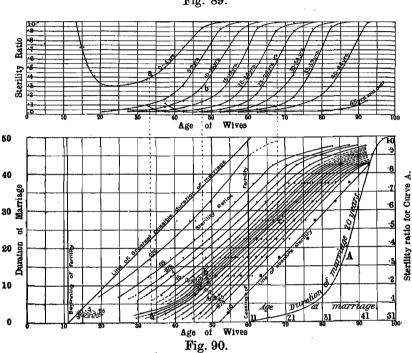


Fig. 89.

In Fig. 89 the ordinates to the curves denote the degrees of sterility: the abscissæ denote the age corresponding to the duration of marriage shewn on any curve in question.

In Fig. 90, the intersections of the curves with the lines of equal sterility on Fig. 89, are projected, to the ordinates-line corresponding to the mean of the range of durations, viz., 2.5, 7.5, 12.5, otc. years. Smoothed curves have then been drawn shewing the probable position of the curves of equal sterility.

Curve A in Fig. 90 denotes the sterility-ratio according to age at marriage where the duration of marriage is 20 years.

On Fig. 90 they represent the projected results, and the lines drawn among them, the smoothed general results deduced therefrom. Thus the

<sup>1</sup> It has been assumed that the group-results for the ranges 0-5, 5-10, 10-15, etc., are sensibly correct for the durations 2.5, 7.5, 12.5, etc., as is evident from Fig. 90. This is not quite exact; the error is not large, however, and the inherent limitations of the determination of the ratio render the measure of uncertainty of but little moment.

<sup>&</sup>lt;sup>2</sup> The three broken lines crossing from Fig. 89 to Fig. 90, indicate the scheme of projection. Thus, the point b, viz., the intersection of the curve assumed to represent a sterility of 0.3 for a duration of marriage of 12.5 years, is found in the graph (plan), Fig. 90, as the point b', viz., on the line parallel to the axis of age at the distance (ordinate) therefrom 12.5, and similarly for point a and c and a' and c'.

new curves so obtained represent completely the sterility-ratios according to age taken in conjunction with past duration of marriage.1

It is obvious that tables shewing average sterility can be constructed

- (i.) according to age at marriage and time since elapsed; and
- (ii.) according to age attained after the given interval between it and marriage.

As, however, the one differs from the other merely by the whole amount of the duration, it is immaterial in which form they are set out. In the following table (CXVIII.) the former method is adopted; Figs. 89 and 90, however, give the age attained after a given duration of marriage.2

TABLE CXVIII.—Shewing for various Ages and Durations of Marriage the Degree of Sterility experienced. Australia, 1911.

			OT DR	ormen c	Phoriem		Lusmam	-,			
			Co	RRESPO	nding :	Durati	ONS OF	MARRI	AGE (IN	YEARS	).
Sterili	ty-Ra	tio.	5	10	15	20	25	30	35	40	45
				v	VHEN T	не <b>А</b> де	ат Маі	RRIAGE	ıs :*		
.025				13.8	15.5	16.6	17.1	17.1	16.7†	16.0†	15.1
.050				19.3	21.3	22.9	23.7	24.3	24.3	24.4	27.6
.075				23.1	24.9	26.3	27.2	27.8	28.0	28.1	31.9
.100			·	25.8	27.6	28.8	29.6	30.1	30.3	30.9	34.1
.150			• •	29.3	30.7	31.8	32.4	32.6	32.5	33.4	37.9
.200			• •	31.6	32.7	33.8	34.1	34.3	34.5	35.4	
.250			• •	33.4	34.3	35.1	35.4	35.7	35.9	36.8	
.300				34.9	35.5	36.2	36.6	37.0	37.2	37.9	
.350			34.0	35.8	36.5	37.1	37.5	37.9	38.0	38.6	
.400		• •	35.1	36.7	37.2	37.8	38.3	38.7	38.8	39.6	
.450			36.1	37.5	38.1	38.7	39.2	39.7	40.0	40.8	
.500			37.1	38.7	38.8	39.5	39.8	40.4	40.9	41.7	
.600	• •	• •	39.0	39.8	40.1	40.7	41.0	41.4	41.7	42.6	
.700			40.8	41.4	41.6	<b>42</b> .1	<b>42.2</b>	42.5	42.8	43.7	
.800			42.5	43.0	43.1	43.3	<b>43.5</b>	43.7	43.7	44.6	
.900			44.5	44.5	44.6	44.7	44.0	44.0	45.0	46.0	
.950			45.9	46.1	46.1	46.2	46.3	46.3	46.3	47.0	
.975	• •	• • •	47.6	47.7	47.7	47.8	47.7	47.6†	47.6†	48.0†	
1.000			51.6†	51.5†	51.4†	51.3†	51.2†	51.1†	50.9†	50.7†	

<sup>\*</sup> The table is thus interpreted:—Beading horizontally, if the age at marriage was say 16.6 years, and the duration of marriage was 20 years, 0.025 would be the proportion without children. Similarly if the age at marriage was 17.1 years, and the duration of marriage was either 25 years or 30 years, or reading vertically, for the duration of marriage of 15 years, if the age at marriage were 15.5, then 0.025 would be sterile; if the age were 21.3, then 0.050 would be sterile; and so on.

† The apparent anomaly in these results may possibly be explained by the more fertile not living sufficiently long to be included in the category of those whose duration of marriage attained the number of years indicated.

The sterility-ratios given in the table for durations of marriage 0-5, do not accord very closely with those deduced by the method of Part

<sup>&</sup>lt;sup>1</sup> Strictly these curves represent the mean of 5-year groups, both as regards duration of marriage and age. The corrections to make them instantaneous results, however, are small.

<sup>&</sup>lt;sup>2</sup> Data have not been compiled which would enable these results to be worked out with very great precision. For this it would of course be necessary to compile according to single years both as regards age and duration of marriage; and give results according to "age at marriage" and "duration of marriage" instead of existing age.

XIII., §§ 11-13, pp. 245 to 250. The probability of a birth, and that of childlessness should together equal unity: For 0-6 years the agreement, however, is closer; see Fig. 71, p. 249, or the values given in Table LXXV., p. 247. As, however, the results for the shorter durations are necessarily somewhat uncertain, these differences are not remarkable. It may be pointed out the results indicated in Table LXXI., p. 238, shew that for the age 51 the probability of a birth is 1.17 per thousand, hence the final value should probably be 0.999, rather than 1.000. But tables of this kind are, of course, probably never reliable to this order of precision.

- Curves of sterility according to duration of marriage.—The sterility-ratios determined from the age of the married woman only, are based upon the assumption that fertility is independent of the age of the husband: this is shewn hereafter not to be the case. Or we may regard the results as true for the average condition (i.e., the condition including husbands of all ages). Continuing this assumption and taking the curve for a duration of marriage of 20 years, it is found that the proportion sterile who are married at the ages 11, 12, . . . 51 respectively are as shewn in Fig. 90, Curve A. The ordinate at age 11 is not necessarily zero, but owing to the fact that marriages at that age usually arise from special circumstances, the value of the sterility-ratio is practically zero. The curve has a point of inflexion, for marriages at about age 40, (i.e.,  $d^2y/dx^2=0$ for x = 40), and the sterility-ratio changes most rapidly at about age 28 (i.e.,  $d^3y / dx^3 = 0$  for x = 28). The curves of sterility can be obtained by plotting the ages in the vertical columns in Table CXVIII., as abscissæ, and the value of the observed sterility as an ordinate. For every given duration of marriage there will be a different curve.
- 24. Fecundity according to age and duration of marriage: various distributions and ratios.—As already pointed out, fecundity is a function of the age of the husband and of the wife, as well, of course, as of the duration of marriage. It has been shewn herein also, for various durations of marriage, that on the average (i.e., the results being for husbands of all ages combined), and for those only who come under observation in cases of birth, the number of children borne, according to duration of marriage (i), is about  $\frac{2}{3} + \frac{4}{11}i$ ; see formula (523) of Part XIII., §§ 34, 35, and Table XC., pp. 279-283. The surface of representation of this is, for the most part, sensibly a plane. It defines the polygenesic<sup>2</sup> distribution, see p. 285; and thus may be called the polygenesic surface. In the case of this distribution differences of age have much less influence, if any, than differences in duration of marriage. It is important to bear in mind, however, that this distribution, as above stated, applies only to a limited

¹ That is the marriages are what have been (somewhat ill-advisedly) called prejudiced"—and do not represent the average liability of becoming fertile.

<sup>&</sup>lt;sup>2</sup> The word "polygenesis" has been used to indicate the origination of a race arising from several independent ancestors or germs. The above use will, however, lead to no confusion, and is consistent with the general mode of word construction. The word polyphorous (from  $\pi \circ \lambda \tilde{\nu} \phi \delta \rho \circ s = \text{bearing many}$ ) is used hereinafter for a different function.

number of married women, viz., those whose total fecundity happens to come under review through repeated child-bearing. In Part XIII., § 36, p. 285, the total number of children borne by married women of given limits of age and duration of marriage has been called the "general genesic," or "fecundity" distribution. For many purposes, however, it is desirable to know the number of mothers (z) instead of the number of children (say, z'=kz,  $k=0, 1, 2 \ldots n$ ) being the number borne by each woman). It is also preferable to relate the number of married women to the exact number, k, of children borne by each. Let, therefore,  $_{0}m$ ,  $_{1}m$ ,  $_{2}m$  . . .  $_{m}m$  denote the number of married women who bore  $0, 1, 2 \dots n$  children respectively, the range of whose ages are between  $x_0$  and  $x_1$ ,  $x_1$  and  $x_2$ , etc., and the range of whose durations-of-marriage are  $t_0$  and  $t_1$ ,  $t_1$  and  $t_2$ , etc., the ages and duration limits, however, being quite independent. Then the various quantities of importance may be embraced by the following distributions, which will hereinafter be de fined, viz.:—(i.) The age-genesic distribution, (ii.) the durational genesic distribution, (iii.) the age-fecundity distribution, (iv.) the durational fecundity distribution, (v.) the age-polyphorous distribution, (vi.) the durational polyphorous distribution, (vii.) the duration-and-age-fecundity distribution, (viii.) the age-and-duration fecundity distribution, (ix.) the duration-and-age polyphorous distribution, and (x.) the age-and-duration polyphorous distribution. The ages may be those at the moment of enumeration or at the moment of marriage: for given purposes either may be required.

These distributions are most clearly defined by means of a symbolic table, Table CXIX., shewing the two types of possible compilation of the results exhibiting the degree of fecundity characteristic of a community. With the aid of this table the various types of distribution—essentially ratios—are readily symbolically represented.

TABLE CXIX.—Scheme of Compilation according (i.) to Age, and (ii.) to Duration of Marriage, exhibiting the Characteristics of the Fecundity of a Population.

(i.)	ther (ii.) Duration-	woma	n wher	e the a	age is	orne by given, o ne durat	or duri	ing the	of (hori-
Group, o	r Group.	0	1	2		k		n	zontal)
$x_0 \text{ to } x_1 \\ x_1 \text{ to } x_2$	$t_0$ to $t_1$ $t_1$ to $t_2$	${}_0^m_1$	${}_{1}m_{1}$ ${}_{1}m_{2}$	$_{_{2}m_{_{1}}}^{2m_{_{1}}}$	••	$k^{m_1} k^{m_2}$	•••	$nm_1 \atop nm_2$	$M_1 \\ M_2$
$x_{p-1}$ to $x_p$	$t_{p-1}$ to $t_p$	$m_p$	$m_p$	$m_p$	••	$k^{m_p}$	••	$n^{m_p}$	$M_p$
$x_{s-1}$ to $x_s$	$t_{s-1}$ to $t_s$	$m_s$	  1 <sup>m</sup> 8	 2 <b>m</b> 8	••	$k^{m_s}$	••	 n <sup>m</sup> s	M,
Totals of (ve	rt.) columns	<sub>0</sub> M	<sub>1</sub> M	<sub>2</sub> M	••	$k^{M}$	••	$n^{M}$	М

To distinguish clearly between (i.) and (ii.), the m and M quantities are not accented for the former, and are accented (m' and M') for the latter. The surface, the z co-ordinate to which is the height above the xk, or the xt plane, as the case may be, is:—

$$(563)....z = f_1(x, k); \text{ or } z = f_2(t, k),$$

in which, of course, k is a variable.

The following table, viz., CXX., gives symbolically the definition of each distribution.

TABLE CXX.—Types of Distribution.

DOUBLE ENTRY DATA.

Age Distribution.	Group	Formulæ.	Durational Distribution.
(i.) Age genesic =	$z_{ag} = {}_{k}m_{p} / M$	$k^{m'}_{p}/M' = z'_{dg}$ $k^{m'}_{p}/k^{M'} = z'_{df}$	= (ii.) Durational
(iii.) Age fecundity =	$z_{af} = {_k}m_p / {_k}M$	$\left  {_{k}m'}_{p} / {_{k}M'} \right  = z'_{df}$	= (iv.) Durational fecundity
(v.) Age polyphorous =	$\mathbf{z}_{ap} = {}_{k}m_{p} / M_{p}$	$k^{m'}_{p} / M'_{p} = z'_{dp}$	= (vi.) Durational polyphorous
The equations of the co for the above are z =	ntinuous surfaces	Equations of the confor the above a	ontinuous surfaces
	TRIPLE EN	FRY DATA.	
A table required for eac	h range of duration	. A table required for	or each age-group.
Age Distributions.	Group	Formulæ.	Durational Distributions.
(vii.) Duration and age fecundity =			
(ix.) Duration and age polyphorous =	$\mathbf{z}_{d.ap} = {}_{oldsymbol{k}} m^{oldsymbol{u}}_{p}  ig/  M^{oldsymbol{u}}_{p}$	$p \left  \frac{k^{m''} p}{p} \right  p M''' = z_{a.d.1}$	(x.) Age and durational polyphorous
The equation of the co- for each range of dura	ontinuous surface ation is $z = f(x,k)$	The equation of the for each range of o	continuous surface duration is $z=f(t,k)$

- 25. The age-genesic distribution.—This distribution furnishes at once the means for determining how a given total of married women may be "partitioned" according to (i.) age, and (ii.) the number of children borne by them. These ratios, multiplied by 1,000,000, are given in Table CXIV., pp. 322-3, for various age-limits. The ignored elements are the durations of marriage and the ages of the husbands.
- 26. The durational genesic distribution.—This distribution similarly furnishes the basis for ascertaining how a given total of married women may be subdivided according to (i.) duration of existing marriage, and (ii.)

number of children borne by them. The ratios multiplied by 1,000,000 are given in Table CXIII., pp. 322-3. The ignored elements are the ages both of the wives and their husbands.

27. The age-fecundity distribution.—This distribution represents the relative numbers, according to age, of married women who bore a given number of children: thus it enables the relative frequency according to age of those who bore any given number of children to be compared, as between one community and another, a fact which will be immediately obvious from the table hereunder. The ignored elements are the durations of marriage and the ages of the husbands.

TABLE CXXI.—Shewing, for Wives of all Durations of Marriage combined, and for each Total Number of Children borne by them (i.e., 1, 2, 3 . . . . to n), the Proportion Contributed by each Age-group indicated.

Australia, Census 3rd April, 1911. Age-Fecundity Distribution.

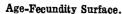
Ages of Wives	of	Ratio to	Result as by Table CXIII.		Ratio	of the	Num	ber in	a giv			p to the		al of a			hose	who	bore	k Chi	l <b>dr</b> en	, whe	re k	s	
Census	Wives	Total	Resu	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	over 20
13	1	00000	00000	0000																					
14	18	00002	00002	0001	0000																				
15	92	00013	00013	0006	0002									1											
16	345	00047	00047	0017	0014	0000						ļ		1											
17	1,061	00145	00145	0048	0047	0004	0000																		
18	2,557	00348	00348	0101	0115	0020	0000					]													
19	4,376	00596	00597	0146	0201	0052	0010	0001																	
20	7,224	00985	00985	0209	0318	0122	0026	0002	0000			l													
21-24	57,896	07890	07894	1378	1991	1313	0630	0215	0054	0016	0001	0000													
25-29	109138	14874	14879	1802	<b>2</b> 596	2495	2008	1377	0782	0357	0142	0050	0013	0002	0003	0000									l
30-34	112523	15335	15337	1376	1720	2085	2200	2048	1754	1316	0881	0478	0240	0107	0052	0023	0008	0007	0000	0002					
35-39	104619	14258	14228	1146	1049	1456	1766	1922	1959	1871	1636	1372	1025	0699	0492	0305	0219	0175	0009	0003					
40-44	95,392	13000	12994	1026	0742	0981	1285	1597	1785	1894	1888	1793	1724	1526	1319	1117	1043	0893	0094	0080	0408	0841	0000	0625	0556
45-49	82,237	11207	11205	0896	0510	0658	0922	1212	1449	1697	1816	1888	1911	1864	1876	1745	1728	1787	0177	0171	1878	1308	1190	3125	0833
50–54	61,447	08374	08376	0669	0304	0378	0549	0770	1003	1199	1467	1659	1840	1874	1952	2019	2005	1973	0189	0205	1918	$2\bar{0}57$	1429	1875	1944
55-59	37,900	05165	05166	0442	0171	0193	0274	0381	0533	0683	0886	1090	1241	1441	1594	1645	1778	1744	0170	0191	1918	1776	2857	2500	1667
60-64	25,065	03416	03417	0314	0100	0113	0151	0229	0318	0440	0565	0726	0857	1045	1150	1349	1284	1448	0152	0147	1838	1776	0952	1875	1667
65-69	16,640	02268	02285	0215	0063	0065	0694	0131	0175	0280	0370	0506	0585	0761	0840	0972	1033	1069	0123	0118	1470	1215	1906	0000	1111
70–74	9,297	01267	01268	0125	0035	0037	0051	0070	0108	0140	0215	0265	0355	0422	0467	0499	0605	0582	0057	0064	0327	0654	1190	0000	2222
75–79	4,254	00580	00581	0058	0016	0021	0023	0031	0052	0076	0030	0121	0154	0197	0814	0253	0243	0260	0024	0016	0122	0373	0476	0000	
80–105	1,691	00230	00233	0025	0006	0007	0011	0014	0028	0031	0043	0052	0055	0062	0071	0073	0054	0062	0005	0003	0121	0000			
<b>13–1</b> 05	733773	1.00	1.00	104761	109720	106195	90218	73962	58482	47045	37540	30537	24399	19317	12805	8841	5023	2575	1280	625	245	107	42	16	36
Totals		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note.—The figures marked with an asterisk are the maxima in the vertical columns and those underlined are the maxima in the horizontal lines.

† The figures though very approximate to those in the column to the left are obtained from a wholly different distribution of unspecified and partially specified cases.

The figures in the body of the table are, of course, decimals. They are not deduced from those given in Table CXIV., pp. 322-3, but from the results of a more detailed distribution of the unspecified quantities for various age and duration-of-marriage groups, see Table CXXIII., p. 338-9 later.

Fig. 91 shews the characteristics of the age-fecundity surface, the age being that at the time of the Census. If compiled according to



the "age at marriage" the form of contours is, of course, materially changed.

tribution.—This distribution is exactly analogous to that preceding, the arguments in the table being limits of dura-

The durational fecundity dis-

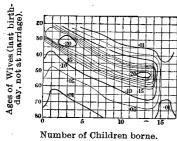


Fig. 91.

tion of marriage and the number of children borne. The values could be obtained roughly from the data in Table

obtained roughly from the data in Table CXIII., by dividing the numbers of wives who bore a given number of children by

the corresponding total (i.e., of the vertical columns, see pp. 322-3). More accurately it could be found from the data given in Table CXXIII. hereinafter (pp. 338-9), the results for all ages being added together for the required numbers.

The ignored elements are the ages of the wives and of the husbands. If instead of being made out for *all* ages, durational fecundity surfaces are determined for various age-groups, their characteristics will not markedly differ, as might be inferred from Table CXVIII., p. 330 hereinbefore.

29. The age-polyphorous distribution.—The data which give the age-fecundity distribution by dividing the tabular numbers by the totals according to the number of children borne, give also the age-polyphorous distribution if divided by the totals of the respective age-groups, see

Table CXXII. hereunder, in which the required ratios are given. The distribution thus shews the relative frequency with which married women in any given age-group bear 0, 1, 2... etc., children.

The ignored elements are the duration of marriage and the age of the husbands.

Fig. 92 shews the characterisics of the age-polyphorous surface, the age being that at the time of the Census. If

# Age-Polyphorous Surface.

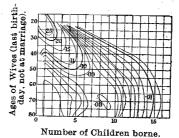


Fig. 92.

compiled according to the "age at marriage" the form of the contours is, of, course, materially changed.

TABLE CXXII.—Shewing, for all Durations of Marriage combined, the Relative Numbers of Married Women of given Age-groups who bore 0, 2, 3 . . . to n Children. Australia, Census of 3rd April, 1911. Age-polyphorous Distribution.

	N.		I	Ratio of	the N	Numbe	r who	bore 1	the <i>k</i> tl	n Chile	i to th	e total	Marri	ed Wo	men o	f the A	ge-gro	ups ind	licated	l, when	e k =	-		
Ages of Wives.	No. of Wives	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Over 20	Total,
13	1	1.000																		[				1.0
14	18	7200	2800																					1.0
15	92	7280	2720				\																	1.0
16	345	5300	4410	0290							٠.													1.0
17	1061	4690	*4850	0420	0040		]					]												1.0
18	2557	4149	*4939	0849	0055	0004	0004	[						]			٠. ا							1.0
19	4376	3497	*5034	<b>12</b> 52	0203	0014				· · · .														1.0
20	7,224	3034	*4828	1789	0324	0022	0003																	1.0
21-24	57,896	2495	*3772	2408	0980	0275	0055	0013	0002	00003														1.0
25-29	109138	1730	*2610	2428	1660	0933	0419	0153	0049	0014	00003	00005	00004	00001				• .						1.0
30–34	112523	1281	1678	*1967	1764	1346	0912	0550	0294	0130	0052	0018	00055	00018	00003	00002	00001	00001						1.0
<b>35–3</b> 9	104619	1147	1100	1478	*1522	1359	1095	0842	0587	0400	0240	0129	0060	0026	0010	0004	0001							1.0
40-44	95,392	1126	0853	1093	1215	*1238	1095	0934	0743	0574	0440	0309	0177	0104	0055	0024	0013	0005	0001	0001				1.0
45-49	82,237	1142	0680	0849	1010	*1091	1030	0971	0829	0700	0567	0438	0292	0188	0106	0056	0028	0013	0006	0002	0001	0001		1.0
50-54	61,447	1140	0543	0652	0806	0927	*0956	0918	0896	0825	0730	0589	0407	0290	0164	0083	0039	0021	0008	0004	0001	0000	0001	1.0 }
55–59	37,900	1222	0495	0540	0653	0743	0823	0847	*0878	0878	0799	0734	0539	0384	0236	0118	0058	0031	0012	0005	0003	0001	0001	1.0
60-64	25,065	1312	0437	0479	0542	0677	0742	0828	0845	*0884	0834	0805	0588	0475	0257	0149	0078	0037	0020	0007	0001	0001	0002	1.0
65-69	16,640	1353	0415	0417	0508	0581	0617	0788	0837	*0928	0858	0883	0647	0516	0312	0165	0094	0044	0022	0008	0005	0000	0002	1.0
70-74	9,297	1408	0417	0419	0498	0559	0682	0713	0869	0869	*0930	0878	0644	0474	0327	0161	0079	0043	0009	0008	0005	0000	0008	1.0
75-79	4,254	1425	0416	0524	0487	0531	0712	0825	0790	0872	0881	*0893	0555	0527	0287	0157	0073	0024	0007	0009	0005	٠		1.0
80–105	1,691	1532	0373	0473	0597	0609	0875	0905	*0958	0934	0798	0710	0538	0385	0160	0095	0035	0012	0012					1.0
13105 Nos.	733773	104761	109720	106195	90218	73962	58482	47045	37540	30537	24399	19317	12805	8841	5023	2575	1280	625	245	107	42	16	36	1.0
Ratio	100000	14277	14953	14472	12295	10080	07970	06411	05116	04162	03325	02633	01745	01205	00685	00351	00174	00085	00033	00015	00006	00002	00005	1.0
Result a		14222	14958	14483	12306	10090	07990	06415	05118	04149	03326	02632	01746	01204	00686	00351	00175	00086	00034	00015	00006	00002	00006	1.0

Note.—The figures marked with an asterisk are the maxima in the horizontal lines, and those underlined are the maxima in the vertical columns, excepting in the case of column 0, where .1126 is the minimum.

† The figures though very approximate to the line above are given by a wholly different distribution of unspecified and partially specified cases.

The figures in the body of the table are, of course, decimals. They are not deduced from those given in Table OXIV., pp. 822-3, but from the results of a more detailed distribution of the unspecified quantities for various age and duration-of-marriage groups, see Table CXXIII., pp. 338-9 later.

30. The durational polyphorous distribution.—The data from which the durational fecundity is derived furnish also the numbers required for the computation of the durational polyphorous distribution, viz., that which shews for given durations of marriage, or between given limits of duration of marriage, the relative frequency with which given numbers of children are borne. The ignored elements are the ages of the wives and of their husbands. This table has not been computed, but the necessary data are given in Table CXXIII. hereinafter.

31. Fecundity distributions according to age, duration of marriage and number of children borne.—The fecundity distribution tables, so far, are of the type z = f(x, y), but if age, duration of marriage and number of children borne, be simultaneously taken into account, then the distribution-frequency is of the type z = f(w, x, y), and cannot be represented by a single three-dimensional graph, for example, height contours upon a plane. It is necessary in fact to have a graph for each value of w adopted in the tabulations.

The exigencies of tabulation, of course, also require that a separate table of the values of z shall be given for each value of one co-ordinate (say w), for the values given by double entry of the other two (say x and y).

In Table CXXIII., hereunder, the results are tabulated for single years of age from 13 to 20, (last birthday), for the ages 21 to 24, and then for every five year age-group onward. The table gives, for existing marriage, the number of wives, of various ages and durations of marriage, who failed to give birth to children, or who gave birth to 1, 2, 3, etc.

In the tables as originally compiled, there was a considerable number of unspecified cases, viz., the following:—

Class (i.), the larger class, in which the ages were specified.

Class (ii.), a relatively small class, in which the ages were not specified.

In each of these were three sub-classes as follow, viz.:-

- (a) in which the duration of marriage was not specified;
- (b) in which the number of children was not specified;
- (c) in which neither the duration of marriage nor the number of children was specified.

It was consequently necessary to effect a distribution in order to get anything like the most probable results.<sup>1</sup>

The method of distribution was that outlined in § 4, Table XCVII., and formulæ (543) to (547). That is to say, sub-class (c) was first distributed proportionately among sub-classes (a) and (b), and sub-classes (a) and (b) of Class (i.) were distributed proportionately among the fully specified cases. In Class (ii.) the corrected sub-classes (a) and (b) were then proportionately distributed among the fully specified corrected groups of Class (i.). The details of the distribution shewed that the result was very satisfactory judged by the regularity of the ratios (see § 5 hereinbefore).

¹ The method of adopting the fully specified cases as characteristic of the whole, involves merely multiplying each by the ratio of the totals. An examination of actual results shewed that recourse to this procedure was unsatisfactory. It rejects part of the evidence available. To distribute the partially specified cases is, therefore, much to be preferred.

TABLE CXXIII.—Shewing, for Various Durations of existing Marriage, the Number of Wives in Various Age-groups who bore k Children, where  $k=0,\ 1,\ 2,\ \text{etc.}$  Australian Census, 3rd April, 1911.

					1	Number	of Wiv	es to w	hom h	ad beer	born (	Childre	n to th	e Numl	per of :								
Duration of Marriage.	Age 13		Age 14.			Age 15.			Age	16.	[			Age 17				×	Ag	ge 1	8.		
——	0	0	1	Total.	0	1	Total	0	1	2	Total	0	1	2	3	Total	0	1	2	3	4	5	Total.
0-5 5-10	1	13			67	25	92	183	152 	10	345	498	514 	45 	4	1,061	1,061 	1,263	$216\\1$	14		1	$^{2,556}_{1}$
Totals	1	13	5	18	67	25	92	183	152	10	345	498	514	45	4	1,061	1,061	1,263	217	14	1	1	2,557
			Age 1	19.					A	ge 20.	_						Age	21-24.					
	0	1	2	3	4	Total.	0	1	2	3	4	5	Total.	0	1	2	3	4	5	6	7	8	Total.
0–5 5–10 10–15	1,530 ::	2,203	548 	84 5	3 3	4,368 8	2,185 7	3,445 43	1,178 114 	140 94	5 11	2	6,953 271	13,947 493	$20,116 \\ 1,725 \\ \cdots$	9,708 4,232	$1,499 \\ 4,175 \\ 1$	$^{104}_{1,482}$	$314 \\ 1$	$\begin{array}{c} 0 \\ 73 \\ 4 \end{array}$	$\begin{smallmatrix}0\\10\\1\end{smallmatrix}$	0 · <u>2</u>	$\substack{45,378\\12,506\\12}$
Totals	1,530	2,203	548	89	6	4,376	2,192	3,488	1,292	234	16	2	7,224	14,440	21,841	13,940	5,675	1,591	319	77	11	2	57,896
*25-29	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	20 Over	Total.
0-5 $5-10$ $10-15$ $15-20$	$\substack{15,392\\3,127\\360\\1}$	20,412 7,205 865 0	10, <b>2</b> 34 14,778 1,480 1	$\substack{1,632\\14,400\\2,082\\5}$	$\begin{array}{c} 144 \\ 7,689 \\ 2,350 \\ 0 \end{array}$	$\begin{array}{c} 5 \\ 2,358 \\ 2,212 \\ 1 \end{array}$	500 1,171 4	 78 453 2	$^{}_{133}^{17}$		  4 1	 4 0	  1										47,819 50,153 11,145 21
Totals	18,880	28,482	26,493	18,119	10,183	4,576	1,675	533	154	33	5	4	1										109,138
*30-34 0-5 5-10 10-15 15-20 20-25	7,788 4,185 2,166 273 2	8,174 6,678 3,459 565 0	4,099 11,083 6,051 906		55 5,759 8,093 1,241	7,022	 466 4,372 1,348 3	 97 2,087 1,122 0	 727 710 5	204 204 377 2	 49 155 2	 13 52 2	  5 15	 2 2	2	1							20,792 40,587 42,077 9,051 22
Totals	14,414	18,876	22,140	19,849	15,149	10,257	6,189	3,306	1,459	585	206	67	20	4	2	1	1			• •	•••	··	112,525
*35-39 0-5 5-10 10-15 15-20 20-25 25-30	4,395 3,060 2,832 1,422 292 1	2,767 3,060 3,210 2,034 435 0	1,307 4,503 5,454 3,458 739	6,288 4,424	24 2,228 6,087 4,782 1,092 0	786 4,943 4,596 1,128	203 3,240 4,297 1,062	60 1,511 3,546 1,019	24 585 2,596 985 0		 57 666 626 0	$egin{array}{c} \\ 24 \\ 281 \\ 324 \\ 1 \end{array}$	 3 106 161 0	68		         11		   1					8,701 17,994 34,443 33,649 9,824
Totals	12,002	11,506	15,462	15,927	14,213	11,458	8,803	6,138	4,190	2,500	1,350	630	270	110	45	12	2	1					104,619
*40-44 0-5 5-10 10-15 15-20 20-25 20-35 30-35	2,236 1,836 1,323 233	787 1,523 1,974 1,999 1,570 287	244 1,530 2,607 3,069 2,587 385 0	1,068 2,626 3,654		3,359	53 1,046 2,931 3,984 890 4	 486 2,227 3,531 835	3 177 1,442 3,034 819	$819 \\ 2,541$	22 387 1,814 721 4	 5 177 957 550 0	65 559 363	~ 264	10 110 109 1		17 33		  3 6	· · · · · · · · · · · · · · · · · · ·	  	   2	3,869 7,288 15,506 25,865 34,308 8,539 15
Totals	10,739	8,140	10,422	11,590	11,809	10,441	8,908	7,087	5,476	4,207	2,948	1,689	988	524	230	120	50	10	9	0	1	2	95,390
*45-49 0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40	1,901 1,882 1,646 1,281 1,444 1,061 175	112 624 1,105 1,055 1,478 1,053 170	$1,479 \\ 2,312 \\ 1,631$	$\begin{array}{c} 854 \\ 1,567 \\ 2,973 \\ 2,441 \end{array}$	$\begin{array}{c} 1\\46\\553\\1,516\\3,364\\3,050\\437\\1\end{array}$		5 168 826 2,870 3,515 601 0	$\begin{array}{c} \\ 63 \\ 466 \\ 2,297 \\ 3,250 \\ 738 \\ 2 \end{array}$	29 277 1,666 3,018 772 0	$^{132}_{1,163}$	3 59 749 2,100 690 0	 16 383 1,459 542 0	12 195 913 422	508	263	88		21	: : : 6 7	·· ·· ·· 0 2 3 ··	 1 3 1	  2 1	2,026 3,029 5,738 9,914 24,368 30,339 6,816
Totals	9,390	5,598	6,985	8,314	8,968	8,472	7,985	6,817	5,764	4,663	3,601	2,402	1,543	868	460	227	107	46	14	5	5	3	82,237
*50-54 0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40 40-45	969 1,221 1,224 877 862 1,019 704 129	1 68 451 600 748 769 590 111	13 208 619 1,055 1,237 749 128	1.742	2 45 406 1,291 2,144 1,580 229	25 219 1,098 2,329 1,893 304	11 119 782 2,244 2,156 331	51 552 2,145 2,275 477	30 352 1,761 2,380 540	1,264 2,414 624	7 83 847 2,049 634	2 44 454 1,439 560	 5 23 268 977 509	11 110 546 339	  49 265 189	   2 22 117 99	1 13 64 49	   6 25 16	   1 14 17	· · · · · · · · · · · · · · · · · · ·		3 3 1	970 1,308 2,099 3,520 8,363 18,424 21,319 5,435
Totals	7,005	3,338	4,009	4,955		5,868	5,643	5,505	5,067	4,489	3,620	2,499	1,784		508	240	128	47	22	6	3		61,447

<sup>\*</sup> Ages at date of Census.

TABLE CXXIII.— Shewing, for Various Durations of existing Marriage, the Number of Wives in various Age-groups who bore k Children, where k=0, 1, 2, etc. Australian Census, of 3rd April, 1911.—Cont.

oo ge-		_		_	I	Vumber	of Wiv	zes to v	whom h	ad beer	n born	Childre	n to the	Numb	er of :-	_		_		_			
Duration of Marriage.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	20 Over	Total.
*55-59 0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40 40-45	466 578 770 630 575 493 544 463 113	 1 60 285 388 398 369 318 57	21 174 387 488 510 398 69	3 75 390 625 751 558 71	 1 37 292 721 889 784 92	 0 8 184 762 1138 898 128	1 4 112 661 1,176 1,069 188	1 73 433 1,286 1,311 222	 0 32 264 1,174 1,583 275	1 26 143 927 1,600 331	   5 93 707 1,515 462 1	5 48 402 1,161 425	2 16 215 873 348	1 11 118 509 254	9 53 261 126	1 23 111 83	1 10 64 44	26 19	     10	:: :: :: io 2	4	   4 2	466 579 856 1,215 2,472 5,167 10,294 13,529 3,321
Totals	4,632	1,876	$2,047_{\parallel}$	2,473	2,816	3,118	3,211	3,326	3,328	3,028	2,783	2,041	1,454	893	449	218	119	47	19	12	4	6	37,900
*60-64 0-15 15-20 20-25 25-30 30-35 35-40 40-45 45-	905 477 459 380 312 422 270 64	22 190 231 203 235 170 44	130 265 267 302 207 29	 74 270 320 397 253 45	22 248 428 551 381 67	 5 168 445 690 468 84	 4 97 417 829 620 108	 1 45 330 802 796 145	297 211 888 887 201	 9 142 687 1,019 234	 5 86 524 1,088 315	 4 35 304 832 297	11 220 642 319	  5 56 401 183	    3 38 207 125	   1 17 105 72	12 45 35	   6 21 18	  4 7 8	  1 1 2	   1 1		905 499 885 1,751 3.216 6,988 8,424 2,397
Totals	3,289	1,095	1,200	1,359	1,697	1,860	2,075	2,119	2,216	2,091	2,018	1,472	1,192	645	373	195	92	45	19	4	3	6	25,065
*65-69 0-15 15-20 20-25 25-30 30-35 35-40 40-45 45-	456 213 340 328 234 204 245 231	 1 30 115 139 154 117 134	 4 73 180 161 159 116	 1 50 157 233 214 191	19 139 278 278 253	$\begin{array}{c} \cdot \cdot \\ 1 \\ 4 \\ 102 \\ 339 \\ 272 \\ 308 \end{array}$	 4 55 335 485 433	1 39 241 554 557	 26 178 591 749	13 103 509 803	  6 56 399 1,009	    2 15 246 813	   3 16 146 694	       447	    2 43 230	      22 131	     63	   3	13	8	· · · · · · · · · · · · · · · · · · ·		456 214 376 594 1,095 2,322 4,363 7,220
Totals	2,251	690	693	846	967	1,026	1,312	1,392	1,544	1,428	1,470	1,076	859	519	275	157	74	36	13	8	0	4	16,640
*70-74 0-20 20-25 25-30 30-35 35-40 40-45 45-	351 139 205 145 119 110 240	 18 75 84 71 139	 1 74 84 98 133	1 24 116 126 196	19 105 133 263	    3 72 191 367	  3 29 187 444	   32 141 633	1 14 100 693	7 1 3 73 788	   1 31 784	   1 18 579	   6 435	   6 298	   0 150	    72				··· ·· ·· · · ·	· · · · · · · · · · · · · · · · · · ·		351 140 225 347 660 1,293 6,281
Totals	1,309	388	390	463	520	633	663	808	808	865	816	598	441	304	150	73	40	8	7	5	0	8	9,297
*75-79 0-30 30-35 35-40 40-45 45-	278 79 70 50 129	 4 32 38 103	 0 26 63 134	$\begin{array}{c} 0 \\ 5 \\ 62 \\ 140 \end{array}$		 2 35 266	 0 37 314	 1 20 315	 0 8 363	 2 6 367	  0 380	   235	  0 224	  120	  0 67	  0 31	  1 9		4			::	278 84 144 361 3,387
Totals	606	177	223	207	226	303	351	336	371	375	380	236	224	122	67	31	10	3	4	2	٠.,		4,254
*0-105 0-35 35-40 40-45 45-	117 38 27 77	 17 45	: 11 69	 11 90	   98	 2 146	  152	 1 161	 1 157	  135	  120	  <sub>91</sub>	65										117 39 76 1,459
Totals	259	63	80	101	103	148	153	162	158	135	120	91	65	27	16	6	2	2					1,691
Totals Ages 13–105 and all Durations of Marriage.	104,761	109,720	106,195	90,218	73,962	58,482	47,045			ı			8,841	5,023	2,575	1,280	625	245	107	42	16	36	733,773
								*	Ages at	date of	Census	3.											

<sup>\*</sup> Ages at date of Census,

From the data furnished, distributions (vii.) to (x.) can readily be computed.

32. The duration and age-fecundity distributions.—For a series of duration-of-marriage-groups these distributions are obtained by computing, for successive age-groups and for each number of children borne, the relative frequency of the mothers within the indicated age-limits who bore a given number of children to the total mothers of all ages (which are included) bearing the same number of children. These results may be obtained by a re-arrangement of the data in Table CXXIII., pp. 338-9. The distribution is (vii.) of Table CXX., p. 333.

The ignored element is only the age of husbands.

- 33. The duration and age-polyphorous distributions.—These, for a series of duration-of-marriage groups, are obtained by computing for a series of age-groups the relative frequency of the mothers within the age-group who bore a given number of children to the total of all mothers in the same age-group (*i.e.*, who bore 0 to n children). The results may be obtained by the same re-arrangement as is required for the distribution referred to in § 32, the present distribution being (ix.) in Table CXX., p. 333. The ignored element is, again, the age of the husbands.
- 34. The age and durational fecundity distributions.—By dividing in each age-group the number of mothers who bore any given number of children, and whose duration of marriage was between given limits, by the total number of mothers who bore the same number of children (i.e., for all durations of marriage in the age-group in question), the ratios in Table CXXIV. hereinafter are obtained. Each series of ratios is the age and durational fecundity distribution for the fundamental age-group. This case is (viii.) in Table CXX., p. 333. The only ignored element is the age of the husbands.
- 35. The age and durational polyphorous distributions.—As in the case of the distributions immediately preceding Table CXXIII., pp. 338-9 furnishes the required data. The series of divisors in each age-group are the totals for the indicated limits of duration of marriage. Thus for married women of a given age and a given duration of marriage, the relative frequency of giving birth to 0, 1, 2 . . . n children are obtained, and these are shewn in Table CXXV. below. This case is (x.) in Table CXX., p. 333, and the only ignored element is again the age of the husbands.

TABLE CXXIV.—Shewing, for a Series of Limits of Duration of Existing Marriage, and according to the Age groups given in the Table, the Ratios of Married Mothers who bore k (where  $k=0,1,2\ldots 20$ , and "over 20") Children, to the Total Number who, for all Durations of Marriage, Bore that Number. Census 3rd April, 1911. Australia. Duration and Age Fecundity Distribution.

Dura-		Propo	rtion of	the Nu	ımber o	f Wome	n who Numb	, with er of	in the Marrie	Indica d Wor	ited L	imit of ho Bo	Dura re k Cl	tion of hildren	f Marri , wher	age, B e k =	ore k	Childr	en to	the To	tal	
of Mar- riage.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	o <b>ver</b> 20
0-5 5-10	1.000	1.000	9988 0012	9533 0467	5714 4286	1,000																
Nos. *13-19	3,353 1.00	4,162 1.00	820 1.00	107 1.00	1.00	1.00	1															
0-5 5-10 10-15	9699 0301	9308 0692	7147 2853	2774 7225 0001	0678 9291 0031	0125 9844 0031	9480 0520	9091 0909	1.00													
Nos. *20–24	16,632 1.00	25,329 1.00	15,232 1.00	5,909 1.00	1,607 1.00	321 1.00	1.00	11 1,00	1.00												•	
0-5 5-10 10-15 15-20	8153 1656 0191	7166 2530 0304	3863 5578 0559	0901 7947 1149 0003	0141 7551 2308 0000	0011 5153 4834 0002	2985 6991 0024	1463 8500 0037	1104 8637 0259	0303 9394 0303	.9000 .1000	1.00	1.00								,	
Nos. *25-29	18,880 1.00	28,482 1.00	26,493 1.00	18,119 1.00	10,183 1.00	4,576 1.00	1,675 1.00	533 1.00	154 1.00	33 1.00	$1.00^{5}$	1.00	1.00									
0-5 5-10 10-15 15-20 20-25	5404 2903 1503 0189 0001	4330 3538 1833 0299 0000	1852 5006 2733 0409 0000	0341 5193 3943 0522 0001	0036 3802 5342 0820 0000	0001 1938 6846 1213 0002	0753 7064 2178 0005	0293 6313 3394 0000	0117 4983 4866 0034	0034 3488 6444 0034	2379 7524 0097	0194 0776 0030	2500 7500 0000	5000 5000	1.00	1.00	1.00		,			
Nos. *30–34	14,414 1.00	18,876 1.00	22,140 1.00	19,849 1.00	15,149 1.00	$10,257 \\ 1.00$	6,189 1.00	3,306 1.00	1,459 1.00	585 1.00	206 1.00	67 1.00	$\frac{20}{1.00}$	$1.00 \\ 4$	1.00	1.00	1.00					
0-5 5-10 10-15 15-20 20-25 25-30	3662 2550 2360 1185 0243	1768	2236	0127 2554 3948 2778 0593	0016 1568 4283 3365 0768	0004 0686 4314 4012 0984	0231 3682 4881 1206	0098 2462 5777 1660 0003	0057 1396 6196 2351 0000	0004 0808 5572 3592 0004	4933	0381 4460 5143 0016	0111 3926 5963 0000	0182 3546 6182 0090	1777 8223	0834 9166	1,00	1.00				
Nos. *35-39	12,002 1.00	11,506 1.00	15,462 1.00	15,927 1.00	14,213 1.00	11,458 1.00	8803, 1.00	6,138 1.00	4,190 1.00	2,500 1.00	1,350 1.00	630 1,00	270 1.00	110 1.00	45 1.00	$\frac{12}{1.00}$	1.00	1.00				
0-5 5-10 10-15 15-20 20-25 25-30 30-35		2456	1468 2502 2945 2482	0020 0921 2266 3153 3135 0505	0003 0484 2062 3268 3519 0662 0002	0222 1744 3217 3989 0828 0000	0060 1174 3291 4472 0999 0004	0010 0686 3143 4982 1178 0001	0005 0323 2633 5541 1496 0002	0002 0169 1947 6040 1842 0000	1313	0030 1048 5666 3256 0000	0658 5658 3674 0010	$\frac{5038}{4428}$	0435 4783 4739 0043	0333 4667 5000	3400 6600	3000 7000	3333 6667	0000	1.00	1.00
Nos. *40-44	10,739 1,00			11,590 1.00	11,809 1.00	10,441 1.00	8,908 1.00	7,087 1.00	5,476 1.00	4,207 1.00		1,689 1.00	988 1.00	524 1.00	$\frac{230}{1.00}$	120 1.00	$\begin{array}{c} 50 \\ 1.00 \end{array}$	10 1.00	1.00	0	1.00	1.00
0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40	1753 1364 1538 1130 0186	1974 1885 2640 1881	1434 2117 3310 2335 0346	1885 3576 2936 0408	0001 0052 0617 1690 3751 3401 0487 0001	0025 0360 1410 3695 3867 0433 0000	1034 3594 4398 0758	0001 0092 0684 3370 4767 1083 0003	0003 0050 0482 2890 5236 1339 0000	5688 1514	0164 2080 5832 1916	0067 1595 6074 2256	$5917 \\ 2735$	1014 5853 3088		0749 5374 3877 0000	0654 6355 2991	0652 4783 4565	0714 4286 5000	0000 4000 6000	2000 6000 2000	6667
Nos. *45-49	9,390		6,985	8,314 1.00		8,472 1.00		6,817 1.00	5,764 1.00	4,663 1.00	3,601 1.00	2,402 1.00	1,543 1.00			227 1.00	107 1.00	1.00	1.00 1.00	1.00	1.00	
0-5 5-10 10-15 15-20 20-25 25-30 30-36 35-40 40-46	$egin{array}{cccccccccccccccccccccccccccccccccccc$	3 0204 7 1351 2 1797 1 2241 5 2304 5 1768 4 033	1 0032 1 0519 7 1544 1 2632 1 3086 8 1868 2 0319	0 0254 1 1140 2 2601 3 3516 3 2172 0 0305	$egin{array}{ccc} 0713 \\ 2266 \\ 3763 \\ 2773 \\ 0402 \\ \end{array}$	0378 1871 3969 3226 0518	0211 1386 3977 3 3820 6 0587	0093 1003 3896 4133 0866	0059 0695 3475 4697	0044 0370 2816 5378 1390	0019 0229 0 2340 0 1752	$egin{array}{c c} 0176 \\ 1817 \\ 5758 \\ 2241 \end{array}$	$\begin{array}{c c} 0129 \\ 1503 \\ 5476 \\ 2853 \end{array}$	0110 1092 5 5422 3 3366	0964 5217 3720		5000 3828	3404	6363 3182	1667 8333	333	3 4285
Nos. *50-5	7,90 1.0	<b>3,33</b> 8			5,697	5,868 1.00			5,067 1.00									47 1.00	1.00	1.00	1.0	3 0 1.00

TABLE CXXIV.—Shewing, for a Series of Limits of Duration of Existing Marriage, and according to the Age groups given in the Table, the Ratios of Married Mothers who bore k (where  $k=0,1,2\ldots 20$ , and "over 20") Children to the Total Number who, for all Durations of Marriage, bore that Number. Census, 3rd April, 1911. Australia. Duration and Age Fecundity Distribution—continued.

Dura- tion		Prop	portion	of the l		of Won	nen wl Nun	no, wit	hin th	e Indi	cated omen	Limit who B	of Du	ration Childr	of Ma	rriage, iere k	Bore	k Chil	dren t	o the '		
of Mar- riage.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	over 20
0-5 5-14 10-1: 15-2: 20-2: 25-3: 30-3: 35-4: 40-4: +45	$\begin{array}{cccc} 0 & 124 \\ 5 & 166 \\ 0 & 136 \\ 5 & 124 \\ 0 & 106 \\ 5 & 117 \\ 0 & 100 \\ 5 & 024 \\ \end{array}$	$egin{array}{cccc} 8 & 000 \\ 2 & 032 \\ 0 & 151 \\ 1 & 206 \\ 4 & 212 \\ 4 & 196 \\ 0 & 169 \\ \end{array}$	0 0103 9 0850 8 1893 2 2384 7 2493 5 1944	$egin{array}{cccc} 3 & 001 \ 030 \ 157 \ 4 & 252 \ 1 & 303 \ 4 & 225 \ \end{array}$	3 0131 7 1037 7 2560 7 3157 6 2784	1 0026 7 0590 0 2444 7 3650 4 2280	0015 0349 2059 0 3665 0 3329	$egin{array}{ccc} 2 & 0003 \\ 0 & 0219 \\ 0 & 1302 \\ 2 & 3867 \\ 0 & 3942 \\ \end{array}$	0096 0793 3528 4757	$0086 \\ 0472 \\ 3062 \\ 5284$	0018 0334 2540 5444	0235 1971 5688 2082	$egin{array}{c c} 0110 \ 1473 \ 6000 \ 21239 \end{array}$	$0 \mid 0123 \\ 0 \mid 1323 \\ 4 \mid 5700 \\ 3 \mid 2844$	$egin{array}{cccc} 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0.200 & 0$	1 1055 3 5092	0841 2 5378	$0426 \\ 5532$	4737			
Nos. *55-5:	4,63 1.0									3,028 1.00		2,041 1,00							19 1.00		1.60	6 1.00
0-1: 15-1: 20-2: 25-3: 36-3: 35-4: 40-4: †45	$egin{array}{cccc} 9 & 145 \ 5 & 139 \ 0 & 115 \ 094 \ 0 & 128 \ 5 & 082 \ \end{array}$	$egin{array}{ccc} 0 & 020 \\ 6 & 173 \\ 5 & 211 \\ 9 & 185 \\ 3 & 214 \\ 0 & 155 \\ \end{array}$	$egin{array}{cccc} 5 & 1083 \\ 0 & 2208 \\ 4 & 2223 \\ 6 & 2517 \\ 3 & 1723 \\ \end{array}$	3 198° 5 235° 7 292° 186°	$egin{array}{cccc} 7 & 1461 \ 5 & 2522 \ 1 & 3247 \ 2 & 2245 \ \end{array}$	1 0908 2 2332 7 3710 5 2516	0467 2 2010 3 3996 3 2988	$egin{array}{ccc} 0212 \\ 1557 \\ 3785 \\ 3656 \end{array}$	0131 0952 4007 4003	C679 3286 4873	$ \begin{array}{r} 0426 \\ 2597 \\ 5391 \end{array} $	$\begin{array}{c} 0238 \\ 2065 \\ 5652 \end{array}$	C095 1846 5386	0868 6217	1019 5550	5 0051 0 0872 5 5385	1304	1333 4667	2105	2500	3333	3333 5000 1667
Nos. *50-6	3,28 4 1.0			1,359								$1,472 \\ 1.00$					92	45	19 1,00	4	3 1.00	
0-18 15-29 20-20 25-30 30-38 35-40 40-48 †45	9 094 0 151 0 145 5 104 0 090	001- 000438 7 166' 1 201- 3 223: 8 1696	5 0058 7 1053 4 2598 2 2328 6 2294	0590 1856 2754 2530	$0196 \\ 1438 \\ 2875 \\ 2875$	0033 0994 3304 2651	0030 $0420$ $2553$ $3697$	$\begin{array}{c} 0280 \\ 1731 \\ 3980 \end{array}$	$\frac{1153}{3828}$		$0381 \\ 2714$		0186 1700	$0058 \\ 1323$	0073 1564	0255 1401	1486	0833	1.00			1.00
Nos. *65- 69	2,25 1.00						1,312 1,00		$\frac{1,544}{1.00}$			1,676 1.00			$\frac{275}{1.00}$		74 1,00	36 1.00	13 1.00	1.00	1,60	1.00
0-20 20-25 25-30 30-35 35-40 40-45 †45	1065 1566 1108 0910	$\begin{array}{c c} 0026 \\ 0464 \\ 1933 \\ 2165 \\ 1830 \end{array}$	$egin{array}{c c} 1 & 0026 \\ 3 & 1897 \\ 5 & 2154 \\ 0 & 2513 \\ \end{array}$	$\begin{array}{r} 0518 \\ 2505 \\ 2722 \end{array}$	$\begin{array}{c} 0365 \\ 2019 \\ 2558 \end{array}$	$\frac{1137}{3017}$	0045 0437 2821 6697	0025 0396 1745 7834	0612 0173 1238 8577	0011 0035 0844 9110	0C12 0380 9608	0017 0361 9682	0136 9864	0197	0000 1.00			1.60	1.00	1.00	0000	1.00
Nos. *70-74	1,309			463 1.00		633 1.00	663 1.00	808 1.00	868 1.00	865 1.00	816 1.66	598 1.00	441 1.60	304 1.00	$\frac{-150}{1.00}$	$\frac{-73}{1.00}$	40 1.00	1.00	1.00	1.00	1.00	8
0-30 30-35 35-40 40-45 †45	1304 1155	1808	$\frac{1166}{2825}$	0000 0241 2996 6763	0265	0066 1155 8779	0000 1054 8346	0030 0595 9375	0000 0216 9784	0053 0160 9787	0000	0043 9957	0000		0000 1.00	000C 1.00	1000 9006	1.00	1.00	1.00	1.00	
Nos. *75–79	606 1.00	177 1.00	223 1.00	207 1.00	$\frac{226}{1.00}$	303 1.00	$\frac{351}{1.00}$	336 1.00	371 1.00	375 1.00	380 1.00	236 1.00	224 1,60	122 1.00	67 1.00	31 1.00	10	1.00	1.00	1.00		
0-35 35-40 40-45 †45		0016 0270 0714	1375 8625	1689 8911	0486 9514	6132 9968	0065 9935	0062 9938	0063 9337	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Nos. 80-105	259 1.00	63 1.00	80 1.00	101 1.00	103 1.00	148 1,00	$\frac{153}{1.00}$	$\frac{162}{1.00}$	158 1.00	135 1.00	120 1.00	91 1.00	$\frac{65}{1.00}$	27 1.00	16 1.00	6	1.00	1.00				
Grand Total	104761	109720	106195	90,218	73,962	58,482	47045	37540	30535 2	4399	9317	12805				i-	625	245	107	42	16	36

<sup>\*</sup> Ages. † 45 and over.

TABLE CXXV.—Shewing, for Various Durations of existing Marriage, the Proportion of Women of Various Groups of Ages, who bore 1, 2, 3 . . . n Children, the Total for each Age-group between the Limits of Duration of Marriage being Unity. Australia, Census of 3rd April, 1911. Duration and Age-polyphorous Distribution.

Dura- tion of		Pi	oport	ion o	of th	e <b>T</b> o	tal of	Wo:	men	withi Childi	n the	Indica	ted L Tumbe	imit o	f Dura	ation hich I	of exis	sting	Marria	age wl	ho bo	ore		Total No. for the
Mar- riage and Age.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	o ver	T'tals	Dura- tion.
0-5 5-10	3972	4931	 0970 1111	0121 5556	0005 3333	0001		::									•••			::	::		1.00 1.00	8,441
*13-19	3968	4925	0970	0128	0008	0001		· · ·													••	••	1.00	8,450
0-5 5-10 10-15	3083 0391	4502 1384	2080 3401	3341	1169	0247 0833	0057 3333	0008 0833	0002				::	::						••	::		1.00 1.00 1.00	52,331 12.777 12
*20-24	$\frac{-}{2554}$	3890	2339	0908	0247	0049	0012	0001	0000			·.											1.00	65,120
$\begin{array}{c}$	$0624 \\ 0323$	$\frac{1437}{0776}$	2140 2947 1328 0476	$2871 \\ 1868$	$\frac{1533}{2109}$	$0470 \\ 1985$	1051	0406	0119	0027	 0004 0476	0004 0000	0476							••			1,00 1,00 1.00 1.00	47,819 50,153 11,145 21
*25-29	1730	2610	${2428}$	1660	0933	0419	${0153}$	0049	0014	0003	00005	00004	00001		• • •								1.00	109,138
0-5 5-10 10-15 15-20 20-25	$1031 \\ 0515 \\ 0302$	$1645 \\ 0822 \\ 0620$	$\frac{1438}{1000}$	$2540 \\ 1860 \\ 1146$	$1419 \\ 1924 \\ 1370$	$0490 \\ 1670 \\ 1374$	$1039 \\ 1489$	$0496 \\ 1239$	$0172 \\ 0784$	$0049 \\ 0416$	 0010 0171 0909	0003 0057 0909	0001 0016	0001 0002	0002	0001	0001	::					1.00 1.00 1.00 1.00 1.00	20,792 40,587 42,077 9,051 22
*30-35	1281	1678	1967	1764	1346	0912	0550	0294	0130	0052	0018	00055	00018	00003	00002	00001	00001				••		1.00	112,525
$15-20 \\ 20-25$	0822 $0423$ $0297$	0932 $0605$ $0443$	$\frac{1583}{1027}$	$1826 \\ 1315 \\ 0961$	$1767 \\ 1420 \\ 1112$	$1435 \\ 1366 \\ 1148$	$0941 \\ 1307 \\ 1081$	$0349 \\ 1054 \\ 1037$	$0170 \\ 0772 \\ 1003$	$0060 \\ 0414 \\ 0914$	0000 0016 0138 0636 0000	0007 0084 0329 1250	0002 0032 0164 0000	0000 0010 0069 1250	0002 0038	0001 0011	0004	0002					1.00 1,00 1.00 1.00 1.00 1.00	8,701 17,994 34,443 33,649 9,824 8
*35-40	1147	1100	1478	1522	1359	1095	0842	0587	0400	0240	0129	0060	0026	0010	0004	0001	0000	0000					1.00	104,619
0-5 5-10 10-15 15-20 20-25 25-30 30-35	$3156 \\ 1443 \\ 0710 \\ 0386 \\ 0273$	$2090 \\ 1274 \\ 0773 \\ 0458 \\ 0336$	$1682 \\ 1187 \\ 0754$	$1466 \\ 1692 \\ 1413 \\ 1058 \\ 0685$	$0783 \\ 1570 \\ 1492 \\ 1212 \\ 0916$	0318 $1174$ $1299$ $1214$ $1012$	$0675 \\ 1133 \\ 1161 \\ 1042$	$0313 \\ 0861 \\ 1030 \\ 0978$	$0114 \\ 0557 \\ 0884 \\ 0959$	$0046 \\ 0317 \\ 0740 \\ 0908$	0014 0150 0529 0844 2667	0003 0068 0279 0644 0000		0010 0077 0271 0667	0004 0032 0128 0667	0001 0016 0070	0005 0039	0001 0009	0001 0007	0000	0001	0002	1,00 1,00 1,00 1.00 1.00 1,00 1,00	3,869 7,288 15,506 25,865 34,308 8,539 15
*40-44	1126	0853	1093	1215	1238	1095	0934	0743	0574	0440	0309	0177	0104	0055	0024	0013	0005	0001	0001	0000	0625	0556	1.00	95,390
10–15 15–20	$     \begin{array}{r}       6213 \\       2869 \\       1292 \\       0593 \\       0350 \\       0257     \end{array} $	$     \begin{array}{r}       2060 \\       1926 \\       1064 \\       0606 \\       0347 \\       \hline       0249 \\     \end{array} $	$0949 \\ 0538 \\ 0355$	0459 $1487$ $1582$ $1220$ $0805$ $0497$	$\begin{array}{c} 0152 \\ 0964 \\ 1529 \\ 1380 \\ 1005 \\ 0641 \end{array}$	$\begin{array}{c} 0069 \\ 0532 \\ 1205 \\ 1285 \\ 1080 \\ 0800 \end{array}$	$0293 \\ 0833 \\ 1178 \\ 1157 \\ 0888$	$\begin{array}{c} 0110 \\ 0470 \\ 0943 \\ 1071 \\ 1083 \end{array}$	$0050 \\ 0279 \\ 0684 \\ 0995 \\ 1133$	$0133 \\ 0477 \\ 0874 \\ 1036$	0005 0060 0307 0692 1012 0000	0157 0482 0795	$0080 \\ 0301 \\ 0619$	0036 0167 0393	$0013 \\ 0087$	0017 0050 0029	0028	0003 0009 0007	0001 0002 0002		0001	0001	1.00 1.00 1.00 1.00 1.00 1.00 1.00	2,026 3,029 5,738 9,914 24,368 30,339 6,816 7
*45-49	1142	0680	0849	1010	1091	1030	0971	0829	0700	0567	0438	0292	0188	0106	0056	0028	0013	0006	0002	0001	0001	0000	1.00	82,237
0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40	9890 9335 5831 2491 1031 0555	0010 0520 2149 1700 0894 0417	0 0099 0 0991 6 1759 1 1261 7 0672 7 0351 1 0236	0031 0600 1605 1452 0946 0505	0015 0214 1153 1544 1164 0741 0423	0119 0622 1313 1264 1 0888	0052 20338 30938 41218	2 0019 3 0143 5 0660 8 1164 2 1063	0020 0020 0085 00427 00956 7 111' 8 0994	0005 0057 0198 3 0686 7 1133	0460	0053 $0246$ $0678$	$\begin{array}{c c} 0028 \\ 0145 \\ 0458 \end{array}$	0013 0060 0256 0624	$0027 \ 0124 \ 0348$	0012 0053 0185	000′	$7 0003 \ 0 0012 \ 0 0029$	00005	'\00004	1 0003	1 0001 2 0003 111	1.00	3,520 8,363 18,424 21,319 5,435
*50-59	1140	054	0652	2222		7 095	0918			5 0730	0589	-	-				_	1 0008	0004	000	1 000	000	1.00	61,447

TABLE CXXV.—Shewing for Various Durations of Existing Marriage the Proportion of Women of Various Groups of Ages, who Bore 1, 2, 3... n Children, the Total for each Age-group between the Limits of Duration of Marriage being Unity. Australia, Census of 3rd April, 1911. Duration and Age-polyphorous Distribution—continued.

Dura- tion of Mar-		]	Propo	rtion	of t	he To	otal o	f Wo	men Chil	withir d <b>r</b> en	the I	ndicate Num	ed Lin	it of in	Durati whic	on of $k = 1$	Existir	ng Ma	arriag	e who	Bor	re		Total No.
riage. and Age.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	o ver 20	T'tals	for the Dura- tion.
0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40	8995 5185 2327 0954 0528 0342	$\begin{array}{c} 0017 \\ 0701 \\ 2346 \\ 1570 \\ 0770 \\ 0358 \\ 0236 \end{array}$	1432 $1565$ $0944$ $0495$ $0294$	0617 $1578$ $1210$ $0730$ $0412$	$1182 \\ 1395 \\ 0864 \\ 0579$	$0066 \\ 0744 \\ 1475 \\ 1105 \\ 0664$	$\begin{array}{c} 0033 \\ 0453 \\ 1279 \\ 1143 \\ 0791 \end{array}$	$0295 \\ 0838 \\ 1250 \\ 0979$	$0129 \\ 0512 \\ 1140 \\ 1157$	$0277 \\ 0900 \\ 1183$	0000 0020 0180 0687 1120	0020 0093 0391 0858	0008 0031 0209 0646	0004 0021 0115 0376	$0051 \\ 0193$	0002 0022 0082		0020					1.00 1.00 1.00 1.00 1.00 1.00 1,00	466 579 856 1,215 2,472 5,167 10,294 13,529
40-45 45 and over	0340	0172	0208	0214	0277	0385	0566	0668	0828	0997	1391 1.000	1280	1048	0765	0380	0250	0132	0057	0030	0006	0000	0006	1.00	3,321 1
*54-59	1222	0495	0540	0653	0743	0823	0847	0878	0878	0799	0734	0539	0384	0236		0058	0031	0012	0005	0003	0001	0001	1.00	37,900
0-15 15-20 20-25 25-30 30-35 35-40 40-45	5186 2170 0970 0604 0320	0441 2147 1319 0631 0336 0202	$\begin{array}{c} 1513 \\ 0830 \\ 0432 \\ 0246 \end{array}$	1542 0995 0568 0300	$\begin{array}{c} 1416 \\ 1331 \\ 0789 \\ 0452 \end{array}$	0959 1384 0988 0556	$\begin{array}{c} 0554 \\ 1297 \\ 1186 \\ 0736 \end{array}$	$\begin{array}{c} 0257 \\ 1026 \\ 1148 \\ 0945 \end{array}$	0656 $1271$ $1053$	0983 1209	$0750 \\ 1292$	0023 0109 0435 0988	0034 0315 0762	0016 0080 0476	0054	0024						0003 0004		905 499 885 1,751 3,216 6,898 8,424
over										0976			1331	0764		0300						0004	1 00	2,397
*60-64	1312	0437	0479	0542	0677	0742	0828	0845	0884	0834	0805	0588	0475	0257	0149	0078	0037	0020	0007	0001	0001	0002	1.00	25,065 ———
0-15 15-20 20-25 25-30 30-35 35-40 40-45 45 and	9953 9043 5522 2137 0379 0562	0047 0798 1936 1269 0663 0268	$\begin{array}{c} 1229 \\ 1644 \\ 0693 \\ 0364 \end{array}$	0842 1434 1003 0490	1197 0637	$\begin{array}{c} 0067 \\ 0932 \\ 1460 \\ 0623 \end{array}$	$0502 \\ 1443 \\ 1112$	$0356 \\ 1038 \\ 1270$	0767 1354	1167	0055 0241 0915	0018 0065 0564	0027 0069 0335	0013 0152			0025	0007					1.00 1.00 1.00 1.00 1.00 1.00	456 214 376 594 1,095 2,322 4,363
over	\				-					1112	1397	1126	0961	0619	0319	0181						0006		7,220
*6569	1000		0417		0581	0617	0788	0837	0928	0858	0883	0647	0516	0312	0165	0094	0044	0022	8000	0005	0000	0002	1.00	16,640
0-20 20-25 25-30 30-35 35-40 40-45	9929 $9112$ $4179$ $1803$	$0071 \\ 0800 \\ 2161 \\ 1273$	$\frac{2133}{1273}$	$0692 \\ 1758$	$0547 \\ 1591$	1091	0433	0485	0212	0028 0045 0565	0015 0240	0015 0139	0046	0047	0000	0008	0007						1.00 1.00 1.00 1.00 1.00 1.00	351 140 225 347 660 1,293
over										1255	1248	0922	0692	0474	0239	0115	0062	0013	0011	8000	0000	0013	1.00	6,281
*70-74	1408	0417	0419	0498	0559	0682	0713	0869	0869	0930	0878	0644	0474	0327	0161	0079	0043	0009	0008	0005	0000	8000	1.00	9,297
0-30 30 35 35-40 40-45 <b>45</b> and	4861	$0476 \\ 2222$	1806	0347	0417	0139	 0000 1025	0069 0554	0000 0222	 0139 0166	:: oòòo	∴ 0028	.: 0000	 0055	.: oòòo	:: oòòo	.: 0028	:: ::	::	::	::		1.00 1.00 1.00 1.00	278 84 144 361
over					0534						1122	0694	0661	0354	0198	0092	0027	0009	0012	0006	••	••	1.00	3,387
*75-79 	1.00	0416	0524	0487	0531	0712	0825	0790	0872	0881	0893	0555	0527	0287	0157	0073	0024	0007	0009	0005	••		1.00	4,254
35-40 40-45 45 and over	9744 3553	2237	1447		0658			-	_										::	::	::		1.00 1.00 1.00	117 39 76
80-105					$\frac{0672}{0609}$						0822 0710	0624	0446	0185	0110	0041	0014				··-		1.00	1,459
											4					. , , ,			••				1.00	1,091

<sup>\*</sup> Totals for ages indicated. Ages at the time of the Census.

36. Fecundity-distributions according to age at marriage.—By subdivision, according to duration of marriage, of the numbers in Table CXXIII., pp. 338-9, and subsequent rearrangement, tables can be prepared giving very approximately the distributions corresponding to the ages at marriage <sup>1</sup>. As this involves the relative numbers marrying at successive ages, it is essential to know the frequency of marriage at given ages. This is furnished by Table LIV., p. 190<sup>2</sup>. The results are as follow:—

TABLE CXXVI.—Shewing the Relative Number of Marriages according to Ages of Brides. Australia, 1907-1914, 3 and the Average Age for each Year Group.

Alleged age (last birthday)	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Mean age No. of marriages	12.66	13.66	14.67	15.67	16.61	15.57	18.54	19,52	20.52	21.49	22.49	23.49		25.49
per 1,000,000	3	13	242	1,620	7,992	22,885	43,889	64,027	81,033	90,337	92,609	87,491	79,199	68,610
Alleged age (last birthday,	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Mean age No. of Marriages	26.49	27.48	28.48	29.48	30.48	31.49	32.49	33.49	34.49	35.49	36,49			39.49
per 1,000,000	58,749	48,897	40,286	33,259	26,627	21,480	16,927	14,553	† 11,548	10,451	9,415	t	†	†
Alleged age (last (birthday)	40	41	42	43	44	45	46	47	48	49	50	51	52	53 to 95
Mean age No. of marriages per 1,000,000	40.49 † 5,931	41,49 † 5,225	42.49 † 4,584	43.49 † 4,003	44.49 † 3,481	45.49 † 3,014	46.49 † 2,598	†	48.49 † 1,906	49.49 † 1,623	50.49 † 1,375	51,49 † 1,160	52.49 † 975	7,064

<sup>\*</sup> Smoothed for misstatement of age. reciprocals of 1.105, 1.110, 1.115, etc.

The preceding table shews that, from the age 18 onwards, the average age is, sensibly, the age last birthday plus one half-year, and no serious error will result if it be so taken even for the ages earlier than 18. Hence a correction can be readily made for the effect of mortality, and a synthetic table prepared in the following way:—

Let a, b, etc., denote the marriages at ages (last birthday)  $x_1, x_2$ , etc., reduced for a half-years' mortality; a', b', etc., these reduced for one and a half years' mortality; a'', b'', etc., the same reduced for two and

<sup>†</sup> Smoothed to a curve by a multiplier changing regularly, viz., the

Original compilation according to age at marriage is, of course, the best method of obtaining the proper numbers.

<sup>&</sup>lt;sup>2</sup> This gives 8 years' experience in Australia of the frequency of marriage at different ages, the total cases being 301,918.

<sup>&</sup>lt;sup>3</sup> These numbers are deduced from those shewn on pp. 190-191 by distributing the 111 unspecified cases.

a half years' mortality, the mortality being both of husbands and wives,<sup>1</sup> and so on. Then, ignoring migration, the numbers according to age, as, at a census, and for a given duration of marriage, will be as shewn in the following table, viz.:—

TABLE CXXVII.—Scheme of Compilation of Numbers according to Duration of Marriage.

Durations				AGE AT	Census.			
of Marriage.	$x_1$	x2	$x_3$	x4	x <sub>5</sub>	x <sub>e</sub>	x <sub>7</sub>	etc.
$ \begin{array}{ccccc} 0 & -1 & \dots \\ 1 & -2 & \dots \\ 2 & -3 & \dots \\ 3 & -4 & \dots \\ 4 & -5 & \dots \end{array} $	a	b a'	$egin{array}{c} oldsymbol{c} \ oldsymbol{b}' \ oldsymbol{a}'' \end{array}$	$egin{array}{c} d \ c' \ b'' \ a''' \end{array}$	$egin{array}{c} e \ d' \ c'' \ b''' \ a^{\mathrm{i}_{\mathrm{V}}} \end{array}$	$egin{array}{ccc} f & & & & & & & & & & & & & & & & & & $	$egin{array}{c} g \ f' \ e'' \ d''' \ c^{ ext{iv}} \end{array}$	etc etc etc etc

The total numbers of married women for durations of 0 to 5 years, 5 to 10 years, etc., are consequently:—

$$(564) \cdot \cdot \cdot_0 M_5 = (a) + (a' + b) + (a'' + b' + c) + (a''' + b'' + c' + d) + (a^{iv} + b''' + c'' + d' + e) + (b^{iv} + c''' + \dots + f) + \text{etc.}$$

$$(565)$$
... $_5 M_{10} = (a^{\mathrm{v}}) + (a^{\mathrm{vi}} + b^{\mathrm{v}}) + (a^{\mathrm{vii}} + b^{\mathrm{vi}} + c^{\mathrm{v}}) + \mathrm{etc}.$ 

$$(566)$$
...<sub>10</sub> $M_{15} = (a^{x}) + (a^{xi} + b^{x}) + (a^{xii} + b^{xi} + c^{x}) + \text{etc.}; \text{ etc.}; \text{ etc.}$ 

It is obvious that a synthetic table can be prepared by means of which the partition can be effected of a group of married women between given limits of age and duration of marriage: in this way the mean age of any element may also be readily ascertained. Obviously the successive quantities vertically are, with sufficient precision for the purpose in view, respectively—in actuarial notation:—

$$m_x(1-\tfrac{1}{2}q'_x)\;;\;m_{x-1}(1-\tfrac{1}{2}q'_{x-1})\cdot p'_{x-1}\cdot p'_x\;;\;m_{x-2}\;(1-\tfrac{1}{2}q'_{x-2})\cdot p'_{x-2}\cdot p'_{x-1}\cdot p'_x$$

m denoting the number of marriages, according to the age of the woman,

<sup>1</sup> For rigorous results the fact must be taken into account that the death of husbands also removes the women from the category "married." Hence the correction for mortality includes the probable number of deaths of wives, and of husbands, diminished, however, by the joint deaths, which are counted, of course, once only.

 $q'_x$  the probability of a woman<sup>1</sup> of age x either dying or becoming a widow within one year, and  $p'_x$  the probability of living in wifehood one year.<sup>2</sup>

Adopting the roughly approximate method we obtain from the data in Table LIV., pp. 190-1, the figures shewn in Table CXXVIII. hereunder.

TABLE CXXVIII.—Shewing	Example of	Computation	of Distribution	of I	Numbers
according to	Age at and I	Duration of Ma	rriage.		

Duration ofm'rriage									AGES	AT CE	nsus.					
Du	12	13	14	12-14	15	16	17	18	19	15-19	20	21	22	23	24	20-24
0-1 1-2 2-3 3-4 4-5	1  	4 1 	73 4 1	78 5 1 0 0	489 73 4 1 0		2,404 488	13,227 6,878 2,398 486 73	13,190	23,033 9,821 2,955	20,198 18,028 13,149 6,837 2,384	20,132 17,969 13,106	27,898 32,502 20,062 17,906 13,060	$27,795 \\ 32,382$	26,249 27,687 32,256	90,093
0-5	1	_5	78	84	567	2,975	9,867	23,062	41,008	77,479	60,596	90,638	111,428	124,356	129,956	516,974
5-6 6-7 7-8 8-9 9-10						  	  	4 1 	73 4 1 	78 5 1 0	483 72 4 1	2,376 481 72 4 1	6,791 2,368 479 72 4	13,012 6,766 2,359 477 72	17,771 12,962 6,740 2,350 475	40,433 22,649 9,654 2,904 552
5-10			••		•• ]		1	5	78	84	560	2,934	9,714	22,686	40,298	76,192

In the above results it is obvious that the age at marriage is at once approximately, though not exactly, obtained for each sub-group by subtracting the "duration" from the "age." The general result may be represented as follows:—

Let s, with appropriate suffixes, denote an element of S, the total between given limits of age and duration of a series of groups of s: then

(567).....
$$s_{x,t}S_{x,t'} = s_1 + s_2 + \dots$$
 etc.;  
+  $s'_1 + s'_2 + \dots$  etc.  
+ etc. + etc. + .... etc.;

 $<sup>^1</sup>$  If husbands and wives were of the same age the probability of mortality which takes both into account would be approximately  $1-\frac{1}{2}q_m-\frac{1}{2}q_f+\frac{1}{4}q_mq_f$  for one half-year, the suffixes m and f denoting male and female respectively. Corresponding changes must also be made in the  $p_x$  factors.

<sup>&</sup>lt;sup>2</sup> For greater rigour account must be taken of the exact interval; the half-year and year is not exactly correct, because the distribution is not uniform. This refinement, however, is not called for, because migration and other irregularities prejudice the data to a much greater extent.

<sup>&</sup>lt;sup>3</sup> Similarly those given in Table CXXVI. could be used, and would perhaps be more reliable as they are smoothed results. The table includes only allowances for deaths of wives: the deaths of husbands have been omitted from consideration.

x and x' denoting the age limits, and t and t' the duration limits. Consequently if G be any given total of a series of groups, and g be the value of any component group, its approximate value is given by

$$(568)...g = G.s/S$$

the suffixes being the same for g and s.

For greater precision the values of s must be taken in Table CXXVIII. as modified not only by death but also by migration. In this way tables compiled according to the ages as at the Census can be reconstructed to furnish results according to the ages at marriage. The recasting of the ages may be effected as follows:—

Let  $x_c$  and  $x_b$  denote respectively the ages at which fertility commences (say 11 or 12), and ends (say 58 or 59);  $t_a$  and  $t_b$  the limits of any duration of marriage adopted in compilation,  $x_1$  and  $x_2$  being also any age limits adopted, as at the moment to which the compilation refers (the Census); then the whole range of ages, x', at marriage is given by:

$$(569)$$
..... $x'_1$  to  $x'_2 \equiv (x_1 - t_b)$  to  $(x_2 - t_a)$ 

because on the inferior side an age will be included less than the lower age limit by the whole amount of the longer term of the duration, and on the superior side an age which is less only by the shorter term of the duration.

<sup>1</sup> The group syntheses (a) in Table CXXVIII. further extended; (b) those obtained by taking no account of deaths, and (c) those given by the Census are respectively as a, b, and c hereunder, a and b being reduced so as to give the same total as at the Census.

Owing to Census defects the Census results (c) cannot be regarded as absolutely correct; and owing to migration effects the synthesis results (a) or (b) will, of course, materially differ from the Census. It is evident, however, that the general correspondence between the Census and the synthetic results is sufficiently well established over a wide range of durations and ages, and that the correspondence furnishes a sufficient reason for relying upon the subdivision of the group-totals into their elements, especially for the earlier ages, and lesser durations of marriage. For age 20, viz., the age at which the misstatements are known to be large, the results are by (a) 7158; 66: (b) 7157; 67: (c) Census, 6953; 271. Corrections for mortality are probably an unnecessary refinement.

Dura-			4	Ages.		m-4al-
tion.	11–14	15–19	20-24	25-29	30-34	Totals.
		<u>'                                    </u>	Synthe	sis (a)		
0-5 5-10 10-15 15-20 20-25		7,523 8 	50,199 7,398 8	49,51 <b>5</b> 49,166 7,239 8	20,894 48,291 47,925 7,052	128,139 104,863 55,172 7,060 8
	8	7,531	57,605	105,927	124,171	295,242
	<u> </u>		Synthe	sis (b)		
0-5 5-10 10-15 15-20 20-25		7,342	49,224 7,347 9	48,750 49,224 7,347	20,637 48,750 49,224 7,347 9	125,967 105,330 56,580 7,356
	9	7,356	56,580	105,330	125,967	295,242
		1	Synthe	esis (c)		
0-5 5-10 10-13 15-20 20-23	5	8,422	52,331 12,777 12	47,819 50,158 11,145 21	20,792 40.587 42,077 9,051 22	
GTt1	. 19	8,431	65,120	109,143	112,529	295,242

Hence it follows that if the age-groups and durations both change by a constant, the range of ages at marriage will be always as above (569). Since ages outside the limits  $x_c$  and  $x_e$  have no significance as regards fertility they may be ignored and consequently the earliest age of marriage may be taken say, as 11, and the latest say, as 58.

If  $x'_2 = x'_1 + 1$  and  $t_b + t_a + 1$ , the range of ages extends over two years. The subdivision by applying the synthetic results can consequently give only approximate results and cannot sensibly attain to the accuracy of "direct compilation according to the age at marriage."

37. Complete tables of fecundity.—Still disregarding the age of husbands, complete tables of fecundity are based, as in the case of sterility, on the age at—and duration of—marriage. They give the proportions of those married at each age who bear 0, 1, 2, 3, etc., children, after the lapse of given durations of marriage. They are most serviceable if developed in the following way, viz.:—

Arguments for each Table:

Age at marriage; and duration of marriage (for the child-bearing period only).

Body of Table.

Proportion—for each increase of 1 year of age, and for each increase of 1 year in the duration of marriage—of the grand total of married mothers who bear 0 children (Sterility table); who bear 1 child; who bear 2 children; etc., etc.

From such a table as the above the derivative tables, previously indicated, can be readily prepared. Tables compiled on the basis of age

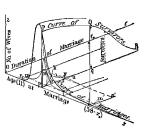


Fig. 93.

at marriage could be distinguished as gamogenesic, etc., see p. 285. Fig. 93, and the notes thereto, exhibit in perspective the nature of the gamogenesic surfaces representing the proportion of wives who, having married at a given age, have borne during a duration of marriage of t years k children.

38. Digenesic surfaces and disogenic contours.—If the husband's age be not ignored fecundity relations become greatly

increased in complexity. For example, instead of a maternity rate or a birth-rate according to the age of wife, we have a series for each age of the

husbands; the compilation-table becomes one of double entry, and the various fertility and fecundity-relations become correspondingly multiplied. If the ages of husbands and wives constitute respectively the abscissæ and ordinates of verticals, the heights of which represent the particular birth-rates, maternity-rates or else that characterise the combinations of ages in question, the surface defined by the totality of the verticals may be called a digenesic surface. That is to say, a vertical z of a digenesic surface is represented by:—

$$(570)\ldots z = \beta$$
.  $F(x, y) = \beta_{xy}$ , or  $\mathfrak{p}_{xy}$ 

where  $\beta_{xy}$  is the birth-rate (or  $\mathfrak{p}_{xy}$  is the maternity rate) for the group of wives of the ages y to y+dy, the ages of whose husbands lie between x and x+dx. To avoid circumlocution let the case be restricted to the consideration of birth-rate only. The curves z= constant, or lines of equal birth-rate on this surface are diisogenic contours (they have been called by Körösi and Galton¹ isogens). Any series of ages x, y, x', y', x'', y'', etc., for which  $\beta_{xy}$  is constant may be called the diisogenous ages. The system of orthogonal trajectories which define the lines of the most rapid increase or decrease of birth-rate for any points through which they pass, may be called the meridians of these points.

The diisogeny of communities has not yet been generally investigated. Körösi has examined the question for the population of Budapest. For Australia the results are given hereinafter, and differ materially from the results for Budapest.

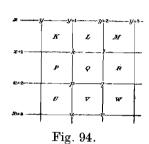
39. Diisogenic graphs and their significance.—Owing partly to paucity in the number of instances when they are distributed into small age-groups, coupled with the fact that even "physiological fecundity" is probably by no means uniform in the human race, and the further fact that the intentional restriction of fecundity is operative in widely different degrees, the crude data, distributed say in year-groups, do not give very definite indications of the exact position of the contours, though they reveal unmistakeably that the birth-rate is not only profoundly affected

<sup>&</sup>lt;sup>1</sup> See, "An estimate of the degrees of legitimate natality as derived from a table of natality compiled by the author from his observations made at Budapest." By Joseph Körösi, Phil. Trans., Vol. 186, Pt. II., pp. 781-875, 1896.

<sup>&</sup>quot;Isogens," by Francis Galton, Proc. Roy. Soc., Lond., Vol. 55, p. 18.

The question had engaged the attention of a large number of persons, for example, A. N. Kiaer, 1875. Stieda, R. Boeckh, Bertillon, Neefe, and others.

by the age of the mother but is also by no means unaffected by the age of the father. It is also evident that, for a considerable range of single-



year age-groups, the relation that  $\beta$  is constant when x+my is constant, is approximately true, a point to which we shall recur; see (576) hereinafter. Thus the problem to be solved is that of determining, from the somewhat irregular surface indicated by the crude data, the more regular surface which ideally defines the general characteristic of birth-rate as related to the ages of the husband and wife, viz., x, y. The magnitude of the accidental differences between single-year age-groups is so large that

meticulous precision is out of the question. Hence, using limited ranges of age we may proceed as follows in order to "smooth" the surface.

Let K, L, M, etc., Fig. 94 denote crude values of the birth-rates for the age-groups x to x+1, y to y+1, etc. Then approximately

(571)..
$$k = \frac{1}{4}(K + L + P + Q); \ l = \frac{1}{4}(L + M + Q + R); \text{ etc., etc.}$$

If this does not give a sufficiently smooth surface we can reconstitute a smoothed value of Q, Q' say, from k, l, p, and q, thus :—

$$(572)\dots Q' = \frac{1}{4}(k+l+p+q) = \frac{1}{16} \left\{ 4Q + 2(L+P+R+V) + (K+M+U+W) \right\}$$

In this last the weight assigned to the values L, P, etc., and K, M, etc., vary reciprocally as the square of the distance to the centre of the group-square from the centre of Q. If the results are extremely irregular it may even be preferable to adopt:—

$$(573)...Q' = \frac{1}{9} (K+L+M+P+Q+R+U+V+W)$$

instead of the preceding formula. The smoothed values being to hand, the contours may readily be drawn. When deemed necessary small corrections can first be applied to the heights for any systematic error introduced by the process of smoothing.

Since the group heights are too small for the central value when the surface is convex upwards, too great when it is concave upwards, a limitation which is accentuated when the mean of a number of heights is formed, as in (571) to (573). This error is analogous to that dealt with in Part IX., §§ 8 and 9, formulæ (311) to (323), and Table XV. The corrections may be ascertained as soon as the surface is approximately determined.

If  $z_k ldots ldots$  to  $z_w$  are the vertical heights of the centres of the squares in Fig. 94, for the average height  $z_0$  for the whole area of 4 squares embraced between the lines joining the points K, M, W, U, would be rigorously

$$(574)...z_0 = \frac{1}{36} \left\{ 16z_u + 4 \left( z_l + z_r + z_v + z_p \right) + \left( z_k + z_m + z_w + z_u \right) \right\}$$

provided the sections of the surface are curves of the third or a lesser degree; or, if the four component surfaces K, L, Q, P, etc., were "ruled surfaces," the height  $z_0$  would be, also quite rigorously:—

$$(575)...z_0 = \frac{1}{16} \left\{ 4z_q + 2 \left( z_l + z_r + z_v + z_p \right) + \left( z_k + z_m + z_w + z_u \right) \right\}$$

If the external factors, therefore, are made unity in (574) and (575) the internal will be, respectively,  $\frac{4}{9}$ ,  $\frac{1}{9}$ ,  $\frac{1}{36}$ , and  $\frac{1}{4}$ ,  $\frac{1}{8}$ , and  $\frac{1}{16}$ . It is evident from these results that the elimination of systematic error involves in all cases the assignment of a high "weight" to the central value. But it is equally certain that if the central values be considered liable to deviations from the general trend of the surface, which, compared with the systematic errors introduced are small, we may practically reach a better result by employing (571) or even (573).

Another and more satisfactory method of obtaining values of  $\beta_{xy}$  is to smooth the series of the values of the type K, P, U, etc.; *i.e.*, with y constant; and independently those at right angles thereto, viz., K, L, M, etc., *i.e.*, with x constant. The means of the two results for each point are then adopted as a first smoothing, and the process repeated as often as is found necessary. This leads to more rigorous results, but can be readily employed only when the original results do not deviate largely from the general trend of the surface.

40. Diisogens, their trajectories and tangents.—The general nature of surfaces such as are here under consideration has been indicated in Pt. XII., §§ 21 and 22, pp. 201-203, and the fundamental formulæ of orthogonal trajectories have been given. The system of contours upon such surfaces (diisogens) probably do not conform to any simple geometrical specification; the present imperfect data certainly do not point to their representation by any system of curves of a simple character, though the settlement of this question must remain for more extended investigation and more accurate data. At any point (x, y) whatsoever, dy/dx furnishes the relation by means of which the birth-rate equivalence

<sup>&</sup>lt;sup>1</sup> The question of the adjustment of such values, has been systematically treated by E. Blaschke, Ph. D., see his "Methoden der Ausgleichung von Wahrscheinlichkeiten," Wien, 1893. See also Phil. Trans., Vol. 186, II., pp. 870-5, 1895. See also Part XII. herein, § 39, pp. 230-2.

of pairs of ages may be expressed in the form  $K\beta = x + G\Delta y =$  a constant. For we shall have, for the direction of the tangent to a disogen,  $dy/dx = \tan \theta = 1/G$  say. Hence it follows that

(576)...
$$x - \Delta y \cot \theta = x - \Delta y \frac{dx}{dy} = C$$
; that is  $x + G\Delta y = C$ 

If k be the recripocal of K then kC will be the constant value of the birth-rate for the diisogen in question. Ordinarily dx/dy is negative.

Parallelism of the tangents of diisogens to the x-axis would imply that the increase of the age of the husband had no influence whatever on the birth-rate, while the parallelism of the tangents to the y-axis would denote that the age of the wife had no influence. If, therefore, the age of the wife has, in general, the preponderating influence, the diisogens must make a smaller angle with the x-axis than with the y-axis. If the diisogens are inclined  $45^{\circ}$  to each axis, then the birth-rate is constant when x+y is constant.

41. **Digenesic age-equivalence** in two populations.—As already shewn, the disogens or their orthogonal trajectories determine the correlative changes in the ages of husbands and wives which give equivalence of birth-rate, *i.e.*, disogeny. The disogenic factor G in formula (576) for any pair of ages (i.e., of husband and wife) is the coefficient which must be multiplied into the age of the wife so that the product, plus the age of the husband, will be continually proportional to the birth-rate. It holds, of course, only for a moderate range of age-differences about the point for which it is ascertained. Thus the expressions:—

(577).....
$$x - y \frac{dx}{dy} = \text{constant}$$
;  $x \frac{dy}{dx} - y = \text{constant}$ ,

apply only to a limited region. For two populations the differential coefficients are not identical. Hence, for a given difference of age in the wife, the equivalent difference of age in the husband is not the same. The factor to make one equal the other may be called the masculine factor of age-equivalence, E. Similarly the factor to make the difference in the wives' age equal, for a given difference in the age of husband, may be called the feminine factor of equivalence, E'. Suffixes can be used to denote the ages (of husband and wife) to which these factors exactly apply.

<sup>&</sup>lt;sup>1</sup> Roughly speaking this represents the general character of the relation indicated (on Table 3, facing p. 852, Phil. Trans., Vol. 186, Pt. II.), by Körösi. Thus, for quite a large range of ages, the birth-rate would appear, according to that authority, to depend merely upon the sum of the ages of husband and wife, and not upon their individual ages. This condition may be called *equilateral diisogeny*, and is probably not a general condition.

Let  $\delta y$  denote any small difference in the age of wives at the point x, y, common to the populations A and B, the tangents to the diisogens making the angles  $\theta_a$  and  $\theta_b$  respectively, with the x-axis. Then since  $\delta x_a = \delta y$  cot  $\theta_a$  and  $\delta x_b = \delta y$  cot  $\theta_b$ , we have

$$(578)...E = \frac{\delta x_b}{\delta x_a} = \frac{\delta y \cot \theta_b}{\delta y \cot \theta_a} = \frac{G_b}{G_a} = \frac{\tan \theta_a}{\tan \theta_b} = \frac{dF_a(x)/dx}{dF_b(x)/dx}$$

Similarly—

$$(579)....E' = \frac{\delta y_b}{\delta y_a} = \frac{\delta x \tan \theta_b}{\delta x \tan \theta_a} = \frac{G_a}{G_b} = \frac{1}{E}$$

that is, the masculine and feminine factors of age-equivalence are reciprocals.

42. Birthrate-equivalences for given age-differences.—The factors of age-equivalence merely disclose the equivalent differences of age for two populations for a given age-difference in either sex, but not the birth

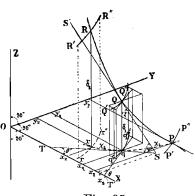


Fig. 95.

rate equivalence. This latter depends not only upon the direction of the tangents to the graphs of the diisogens in plan (i.e., upon the tangents to their horizontal projections), but also to the angle of slope  $\psi$  of the orthogonal trajectories. The tangent to any point  $\mathbf{Q}$ , on a trajectory will be required. The angle it makes with the z-axis will be  $\zeta$  so that  $\zeta + \psi = 90^{\circ}$ . The following procedure will always be abundantly accurate for determining the age-equivalence and digenesic efficiency for any point  $\mathbf{Q}$  the co-ordin-

ates of which in plan are  $x_q$ ,  $y_q$ . Let P'P P'', Q'Q Q'', and R'R R'' in Fig. 95 be three diisogens (the values of which are known), crossed by the orthogonal trajectory P, Q, R, which in general is, of course, a curve of double curvature (tortuous curve). Let this trajectory be projected orthogonally on to the horizontal plane X O Y passing through P: this projection is the broken line P q r, the projections of short stretches of the diisogens being similarly the broken lines q'q q' and r'r r''; P'P P'' is itself in the plane of projection.

Let the curved line Pq be denoted by  $X_1$ , and the curved line Pr, of which Pq forms part, by  $X_2$ , measured along the curve; and let also the difference of birth-rates for P and Q (i.e., Qq) be denoted by  $\delta_1$ , and the

difference for P and R be denoted by  $\delta_2$ ; then we may assume that the curved triangle, PQRrqP in relation to lengths along the curved axis Pqr, is, with sufficient precision, given by  $\delta=b\chi+c\chi^2$ , and therefore that the tangent at the point Q is  $d\delta/d\chi=b+2c\chi$ . Thus we shall have:—

(580)..tan 
$$\psi = \frac{1}{\chi_2 - \chi_1} \left\{ \delta_1 \frac{\chi_2}{\chi_1} - \delta_2 \frac{\chi_1}{\chi_2} + 2\chi_1 \left( \frac{\delta_2}{\chi_2} - \frac{\delta_1}{\chi_1} \right) \right\}$$

When  $\delta_2 = 2\delta_1$ , this becomes

(581).....tan 
$$\psi = \frac{\delta_1}{\chi_1} \cdot \frac{\chi_2^2 - 2\chi_2\chi_1 + 2\chi_1^2}{\chi_2 (\chi_2 - \chi_1)}$$

and when, in addition,  $\chi_2 = 2\chi_1$ , the expression becomes, of course,

$$(582).....\tan \psi = \delta_1/\chi_1 = \delta_2/\chi_2$$

The direction of this line of slope tangentially passing through Q, and making the angle  $\psi$  with the horizontal plane, is shewn by the projection SqT, which is tangential to pqr, passing tangentially through the point q. It, of course, makes the angle  $\theta'$  with the OX axis. Consequently the angles  $\theta'$  and  $\psi$ , or their complements  $\theta$  and  $\zeta$ , give all the necessary relations required.

Since the line, Qq, in the figure  $= \delta_1 = \beta_q - \beta_p$ , viz., the difference of birth-rates indicated by the disogens at P and Q, the horizontal equivalent thereof, Sq = s, say, measured in the direction of the tangent to the orthogonal trajectory at Q is:—

$$(583).....s = \delta_1 \cot \psi = (\beta_q - \beta_p) \tan \zeta$$

since  $\zeta + \psi = 90^{\circ}$ . Thus, in plan, the rate of change of the birth-rate at any point x, y on a disogen can be ascertained from the position of the disogens on either side, and the position of the orthogonal trajectory through the point. Thus the age-equivalence of this difference of birth-rate is to be found by *dividing* by the sine and cosine of the angle which the orthogonal trajectory makes with the co-ordinate axes,  $\theta$  and  $\theta'$ ; their sum,  $\theta + \theta' = 90^{\circ}$ . Consequently the masculine birth-rate-equivalence, H say, for wives of the one age, is:—

$$(584)...H = (\beta_q - \beta_p) \tan \zeta \csc \theta$$

since  $1/\sin\theta = \csc\theta$ , and the feminine birthrate-equivalence H', for husbands of the one age, is

$$(585),\ldots,H'=(\beta_{y}-\beta_{p})\tan\zeta\sec\theta$$

We thus have, from these two equations, for two populations, A and B for any common small difference of birth-rate, the ratio :—

$$(586)......\frac{H_b}{H_a} = \frac{\tan \zeta_b \operatorname{cosec} \theta_b}{\tan \zeta_a \operatorname{cosec} \theta_a}; \text{ and } \frac{H'_b}{H'_a} = \frac{\tan \zeta_b \sec \theta_b}{\tan \zeta_a \sec \theta_a}$$

These relations, however, can be determined very readily from appropriate graphs of the populations.

43. **Diisogeny in Australia.**—Diisogeny is doubtless best exhibited by the maternity rates, not the birth-rates, the ratios to be ascertained being the proportions which the number of cases of maternity bear to the number of women at risk in any age-group with husbands of any age-group.

In order to ascertain the nuptial maternity rates of Australia according to pairs of ages, the nuptial cases of maternity have been taken out for the seven years 1908 to 1914 inclusive, that is, for the Census year 1911, and for the three years before and after that year. In order to relate these cases of maternity in age-groups to the numbers of married couples in the same age-groups at the Census, they have been divided, not by 7, but by a number which gave the true average, viz., 7.13143. The results thus obtained are shewn by the uppermost of the figures in Table CXXIX. hereunder. Thus the results used are equivalent to a total 5,232,988 married women, among whom maternity was experienced 814,617 times. This gives an annual maternity rate of 0.15567. But of this number of married women, 7.6368 per cent. were 60 years of age and over, and 12.7667 per cent. were 55 years of age and over, so that about 87 per cent. were of child-bearing age. Hence the birth-rate for married

<sup>&</sup>lt;sup>1</sup> This figure was ascertained in the following way:—The number of females in the years 1908 to 1914 inclusive were multiplied by a linear changing ratio (determined from the intercensal period 1901-1911) in order to obtain the numbers of married women during the years in question, the results being as hereunder:—

$\begin{array}{cccccccccccccccccccccccccccccccccccc$	= 677,377 = 696,148 = 716.832 = 740,725 = 769,827 = 802,363 = 829,716	Total population Census population All females, 7 years Census females Total married females, 7 years Census year (whole)	$ \equiv \frac{31,697,285}{4,455,005} $ $ \equiv \frac{15.224,455}{2,141,970} $ $ \equiv \frac{5,232,988}{734,226} $	= 7.11498 $= 7.10769$ $= 7.12722$
Total No. of married women in 7 years No. at Census date	$\frac{5,232,988}{733,773}$			$\equiv 7.13162$
Total births in 7 years Births in Census year				$\equiv 7.12758$

This was found to agree with other deductions as to the number of years, viz.,  $7 + \epsilon$  where  $\epsilon$  was a small fraction (as shewn above) varying between 0.10769 to 0.13162. The actual division used was 7.13143, the reciprocal of which is 0.140224. This, multiplied into the births during the 7 years, gave the uppermost figure shewn in the table.

women of 13 to 54 years of age inclusive was 0.17845, or for women of 13 to 59 years of age inclusive, 0.16854. Körösi's results were 46,926 children from 71,800 married couples, in 4 years, that is 0.16339 per annum.

The numbers of husbands and of wives recorded in the Australian Census of 3rd April, 1911, were not equal. It was deemed probable that the number of wives recorded would be the best basis for determining the distribution according to the age of the married women at the Census: in this way the numbers exposed to risk are ascertained in each agegroup. The adjusted distribution<sup>2</sup> gives the numbers which constitute the denominators of the ratios.

In general there is a considerable number of cases for each pair of age-groups adopted; the table discloses the number. It is evident, however, that in extreme instances the numbers are small, and the maternity rates consequently ill-determined.<sup>3</sup> They may be regarded, however, as well ascertained where the number of mothers has been shewn in heavy figures.

The age-distribution as at the Census probably differs but little from the average distribution over the 7 years, which yielded the births: hence the ratios ascertained may be accepted as very closely representing the true amounts. The results are shewn in Table CXXIX. hereunder.

<sup>&</sup>lt;sup>2</sup> The following is a conspectus of the data:—

94.0		Unspecified as regards Wife's Age.	Husbands whose Wives were with them.	Husbands whose Wives were Absent.	Total Husbands
Unspecified as regards husband's age Wives whose husbands	2,368	4,108 506	620,846 2,874	11,084 1,045	3,919
were with them Wives whose husbands	619,106	4,614	623,720	112,129	735,849
were absent	108,892	1,161	110,053	• •	
Total Wives		5,775	733,773		

The adjustment was effected as follows:—The 506 doubly unspecified cases were divided into 185 and 321, that is in the proportion of each to their sum, and those were distributed proportionally among the wives and husbands unspecified. Next the 1161 wives, unspecified as regards age, were distributed proportionally among the 108,892 whose ages were given, thus making up the total 110,053. A like proceeding was followed in the case of the 1045 husbands, unspecified as regards age, so as to make the total 112,129. The individual totals were then reduced by multiplying throughout by 0.981485, so as to form the same aggregate 110,053 as in the case of the wives. One half of each was then distributed proportionally to the individual original numbers, thus making the grand total 733,773. See Table I., pp. 1106-7, Vol. III., Census Report.

 $<sup>^1\,\</sup>rm The$  average crude birth-rate for Australia for 1908-14 was .02745, and for Hungary for 1908-12, 0.3632. Apparently the Budapest maternity-rate is not larger than that of Australia.

<sup>&</sup>lt;sup>3</sup> In general, tables prepared in this manner have the advantage that it may at once be seen whether any change of a ratio, necessary to make it conform to a general law, is probable or otherwise. A result like that shewn for ages of husbands 17, and of wives 16, viz., 1.55, is of course not impossible, but it would not be true for a very large number of cases.

TABLE CXXIX.—Shewing the Average Number of Cases of Maternity per annum for Married Couples of various Pairs of Ages, based upon 814,617 Cases of Maternity and 5,232,988 Couples; the Number of Couples to whom they may be referred, and the Corresponding Birth Rates for the Groups, in Australia during the 7 Years, 1908-1914. Diisogenic Distribution (for Maternity).

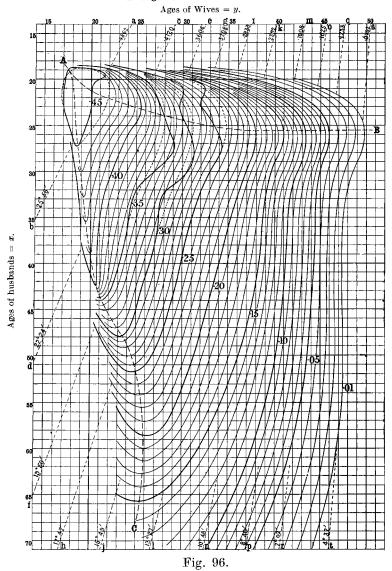
Ages of Husbands.											A	GES OF	WIVE	s.												Total Number
A ges Husb	13	14	15	16	17	18	19	20	21–24	25–29	30-34	35-39	40–44	45-49	50-54	55–59	60-64	65-69	70–74	75-79	80-84	85– 89	90- 94	95- 99	Matern- ity.	of Wives.
14		.:	0.0			::	::			::		:-					::			::						2
15			0.0	0.0 1 0.0		0.0 1 0.0		$0.1 \\ 0.05$	0.1			::	••	••	••		••								0.2	4
16			0.0 3 0.0	$0.8 \\ 4 \\ 0.2$	1.0 2 0.5	0.1 3 0.03	$0.4 \\ 0.2 \\ 0.2$	0.1 1 0.1	$0.6 \\ 1 \\ 0.6$	$0.1 \\ 0.1 \\ 0.1$															3.1 	17
17		0.4 ?	$0.3 \\ 1 \\ 0.3$	$2.1 \\ 2 \\ 1.55$	3.9 8 0.49	$^{3,1}_{6}$	$\begin{array}{c} 3.1 \\ 10 \\ 0.31 \end{array}$	$^{1.8}_{6}$	$1.4 \\ 15 \\ 0.09$	2.0 ?	0.1 ?			::	··· ···							 			18.2 	48
18		0.1 	$1.0 \\ 4 \\ 0.25$	7.0 10 0.70	15.8 <b>31</b> 0.51	21.9 <b>57</b> 0.38	15.8 <b>39</b> 0.41	8.4 <b>20</b> 0.42	10.1 <b>36</b> 0.28	0.4 <b>6</b> 0.07	0.1 ?											 			80.6	203
19	0.3 ? 	0.0 ?	2.4 ? •••	14	30.7 67 0.458	$\begin{array}{c} 66.9 \\ 111 \\ 0.602 \end{array}$	71.5 98 0.729	43.0 <b>73</b> 0.589	53.6 <b>126</b> 0.425	7.3 <b>29</b> 0.251	0.7 <b>8</b> 0.09	0.0 <b>3</b> 0.0	•••	•••	:: ::				::				::	• •	290.0 	 529 
20	0.0 1 0.0	4	$1.4 \\ 16 \\ 0.09$	$^{13.6}_{\begin{subarray}{c}29\\0.468\end{subarray}}$	86	94.8 1 <b>80</b> 0.526	142.9 <b>255</b> 0.560	134.8 <b>302</b> 0.446	185.1 434 0,426	24.7 <b>75</b> 0.329	3.2 12 0.27	$0.8 \\ 3 \\ 0.27$	0.0 <b>3</b> 0.0	 			••	 				•••	••	 	645.5 	1,400
21 to 24	0.1 ? 	2.4 3 0.8	$\begin{array}{c} 8.3 \\ 35 \\ 0.237 \end{array}$	126		578.1 <b>1,099</b> 0.526	1,048.9 <b>1,916</b> 0.547	1,338.2 <b>2,889</b> 0.463	13,541	1,747.9 5,028 0.347	180.7 <b>762</b> 0. <b>2</b> 37	27.9 <b>154</b> 0.181	4.3 <b>42</b> 0.10	0.3 <b>20</b> 0.015	0.0 <b>5</b> 0.0		••	•••				::	••	::	11295.3	26,071
to 29	0.1 ···	0.4 1 0.4	24	99	124.1 <b>301</b> 0.301	361.1 <b>725</b> 0.498	706.7 <b>1,413</b> 0.429	1,126.1 <b>2,567</b> 0.477		13,001.3 <b>38,398</b> 0.338	2,321.9 <b>8,387</b> 0.276	302.6 <b>1,435</b> 0,210	30.9 <b>275</b> 0.112	1.8 <b>81</b> 0.022	0.0 <b>32</b> 0.0	8	1	1		<u> </u> ::		::	::	::	28458.8	79,749
30 to 34		0.1 ?	5	8.8 <b>37</b> 0.238	32.7 <b>66</b> 0.495	90.2 <b>232</b> 0.388	193.9 <b>441</b> 0.439	374.1 <b>904</b> 0.413	4,383.8 11,814 0.371	11,421.4 <b>38,291</b> 0.298	9,338.4 <b>38,816</b> 0.243	1,5 <b>32</b> .5 <b>8,672</b> 0.176	137.4 1,635 0,083	4.6 <b>376</b> 0.0122	91	22	. 8	4		L:	::	:: ::		::	27519.6	101,415
35 to 39			0.8 4 0.2	6	10.2 <b>31</b> 0.329	30.4 93 0.327	64.6 138 0.467	113.6 <b>281</b> 0.404	1,381.8 3,897 0.354	17,480	8,024.6 <b>36,510</b> 0.220		630.1 <b>7,844</b> 0.0803	15.3 <b>1,476</b> 0.00103	0.4 <b>282</b> 0.0014	67	12	∷ g		2	1			···	21403.9	102,559

Ages,	13	14	15	16	17	18	19	20	21-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65–69	70–74	<b>7</b> 5–79	8084	85- 89	90- 94	95 <b>-</b> 99	Totals	Totals
40 to 44	::		$0.4 \\ 3 \\ 0.13$	$0.3 \\ 5 \\ 0.06$	$\begin{array}{c} 4.1 \\ 6 \\ 0.68 \end{array}$	6.9 <b>20</b> 0.345	20.8 <b>61</b> 0.341	35.6 88 0.404	450.7 <b>1,386</b> 0.324	1,745.5 <b>6,529</b> 0.267	3,876.4 18,471 0.2098	5,302.7 <b>34,517</b> 0.1536		61.7 <b>7,358</b> 0.00838	0.4 <b>1,450</b> 0.00028	340	70	27	··· <sub>7</sub>	3	::	::	::	::	14014.7 	102,903
45 to 49		0.1 	$\begin{array}{c} 0.1 \\ 1 \\ 0.1 \end{array}$	0.7 ?	$^{1.5}_{5}$	$\begin{array}{c} 3.6 \\ 10 \\ 0.36 \end{array}$	7.9 16 0.493	10.5 <b>44</b> 0.238	155.9 <b>507</b> 0.307	612.3 <b>2,381</b> 0.257	1,322.3 6,884 0.1922	2,587.4 1 <b>7,242</b> 0.1500	2,160.3 <b>32,140</b> 0.0672	297.1 <b>29,881</b> 0.00995	0.7 <b>6,525</b> 0.00011	1,100	259	<sub>73</sub>	i2	7	••				7160.4 	97,087
50 to 54				$0.4 \\ 0.13$	$0.8 \\ 1 \\ 0.8$	$1.9 \\ 4 \\ 0.47$	$\begin{array}{c} 2.4 \\ 11 \\ 0.22 \end{array}$	4.5 10 0,45	47.8 179 0.267	177.9 798 0.2229	401.6 <b>2,289</b> 0.1754	727.1 <b>5,675</b> 0.1281	859.7 <b>14,352</b> 0.0599		3.5 <b>22,679</b> 0.00015		876	241	39		3	;			2414.9 	78,458
55 to 59				::	::	$0.0 \\ 4 \\ 0.0$	0.8 5 0.16	1.3 5 0.26	12.2 <b>65</b> 0.187	53.5 <b>247</b> 0.216	102.8 <b>680</b>	203.0 1,771 0.1146	198.8 <b>4,192</b>	60.9	15.4 1 <b>7,599</b>	0.0		521	iż1		9				648.7	51,350
60 to 64			::		0.1 	$0.1 \\ 1 \\ 0.1$	$0.3 \\ 2 \\ 0.15$	0.1 1 0.1	5.7 $33$ $0.172$	17.8 <b>100</b> 0.178	38.1 <b>265</b> 0.143	54.1 <b>596</b> 0.0907	59.7 <b>1,438</b>	11.5 <b>3,453</b>	0.7 <b>7,583</b> 0.00009	0.0	8,319	1,834	 378	65	 15	1	 <sub>2</sub>		188.2 	34,677
65 to 69			••					0.7 •••	2.2 17 0.129	7.6 <b>45</b> 0.106	14.8 11 <b>5</b> 0.128	17.6 <b>307</b> 0.057	16.7 <b>626</b> 0.0266	5.3 <b>1,404</b> 0.0037	0.0 <b>3,150</b> 0.0	0.0 <b>5,192</b>	7,466	5,989	1,281	234	35		::		64.9	25,869
70 to 74			 				••		0.3 6 0.05	$^{1,1}_{19} \\ _{0.058}$	$^{1.8}_{43} \\ _{0.042}$	$3.9 \\ 133 \\ 0.029$	$\begin{array}{c} 3.1 \\ 238 \\ 0.013 \end{array}$	$\begin{array}{c} 2.0 \\ 542 \\ 0.004 \end{array}$	0.0 1,151 0.0	0.0 2,014	3,411	4,700	3,541	801		14			12.2	16 717
75 to 79	••		::			0.0 1 0.0	0.0 0 0.0	$0.0 \\ 1 \\ 0.0$	$0.3 \\ 2 \\ 0.15$	$0.4 \\ 16 \\ 0.025$	$^{1.9}_{21} \\ _{0.090}$	$1.8 \\ 42 \\ 0.043$	2.1 98 0.021	$\begin{array}{c} 1.1 \\ 202 \\ 0.005 \end{array}$	0.0 395 0.0	0.0 632	1,277	2,332	2,593	1,786	332	36			7.6	9,774
80 to 84						0.0 1 <b>0</b> .0	0.0 0 0.0	0.0 0 0.0	0.0 1 0.0	$0.1 \\ 2 \\ 0.05$	$\begin{array}{c} 0.7 \\ 11 \\ 0.63 \end{array}$	0.7 18 $0.39$	0.4 32 0.013	$0.1 \\ 61 \\ 0.002$	0.0 117 0.0	0.0 176	367	587	908	891	549	82	26		2.0	3,829
85 to 89		  ::			::			 ::	0.0 1 0.0	0.1 0 ?	$0.0 \\ 1 \\ 0.0$	$0.1 \\ 5 \\ 0.02$	0.0 7 0.0	$0.0 \\ 12 \\ 0.0$	0.0 21 0.0	0.0 42	67	i117	i58	 221	i. 156		7		0.2	904
90 to 94			::				 			$0.0 \\ 1 \\ 0.0$	0.0 0 0.0	0.0 0 0.0	0.0 1 0.0	0.0 5 0.0	0.0 1 0.0	0.0		32	 34	·. 29	34	20			0.0	 <sub>173</sub>
95 to 99										::	::					0.0 0.0 1 0.0	1	  5	5	5		5				28
100 and over									::		::		::			0.0 0.0 4 0.0	0	3	::		::					7
T'tls	0.5	3.5 8	21.3 98		497.2 1,055		2280.0 4,407	3192.9	23206.8 58,062	33975.3 109,446		16737.0 104,998	6612.7 95,485	649.0 82,098	21.4 61,082		24,850	16,474	9,080	4,086	1,237	255	54	1	114229.0	<b>733,77</b> 3

Note.—The uppermost number denotes the average number of births deduced from 7 years' results. The middle number is the number of married women in the age-group at the Census of 1911, viz., the middle year of the 7 years referred to.

The lowest number is the maternity rate deduced by dividing the uppermost by the middle number.

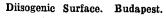


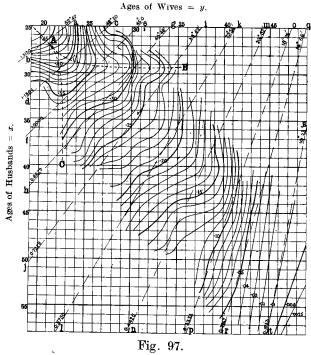


The maternity rates shewn, denote the ratio of the average number of cases of maternity occurring to the number of wives at risk, whose ages are shewn at the top line of the figure, their husbands' ages being shewn at the left hand side of the figure. The dotted lines roughly represent the major part of the surface between the principal meridians AB and AC.

The results tabulated above, and slightly smoothed, are shewn on Fig. 96, in which the heavy lines, viz., the birth-rates ·05, ·10, ·15, . . . . ·45, are first ascertained from the tabular results, and then smoothed. The thin lines, shewing differences of ·01 in the maternity rate, are then drawn in (having regard to second differences). The diisogens 0·45, 0·35,

0.30, and 0.25 exhibit some peculiarity. This is probably not due to physiological differences in fertility; the dotted lines are believed to better represent the character of the physiological law (modified, of course, by the incidence of social traditions). The broken line A B is one of the principal meridians of the surface, and denotes the ages where small differences in the ages of the husbands have no effect on the fertility. The broken line A C is the other principal meridian, and denotes the ages where (very) small differences in the age of the wives have no effect. As the higher ages—during the fertile period of woman's life—are reached, the age of the husband has apparently very little influence at least from 35 to 65 years of age. The graph, Fig. 96, however, requires no interpretation.





44. **Diisogeny generally.**—Körösi's results  $^1$  for Budapest (as rereduced by me) are shewn on Fig. 97. The results for individual ages shew great irregularity, but were computed as indicated hereinbefore, §§ 38 and 39. The irregularities doubtless would disappear with larger numbers. It will be seen in Fig. 97 that at age 36 for husbands and 30 for wives, the direction of the diisogen is inclined 45° to the axes x and y for a considerable length thereof and that, for an extended range of ages of husband and wife, the relation roughly holds that the birth-rate is

<sup>&</sup>lt;sup>1</sup> Phil. Trans., Vol. 186, Pt. II., pp. 781-875.

constant when the *sum* of the ages of husband and wife are constant, and further that it *decreases* with *increase* in this sum.<sup>1</sup> The statement acquires greater generality, however, if put in another way, viz.:—

For ages greater than that of the maximum fertility of women and for those combinations of ages of husband and wife which are most common, the fertility-ratio may be regarded as represented-very roughly of course—by straight lines: that is to say, x and y being respectively the ages of husband and wife at the time of the birth, the fertility-ratio is constant when kx + y is constant. These constant values are typically represented by the lines ab, cd, ef, etc., on Fig. 97, and by a'b', c'd', e'f', The pairs of ages, x and y, which give identical fertilityetc., on Fig. 96. ratios, may be called corresponding age-pairs. They do not, of course, actually lie on straight lines, as is evident from either Fig. 96 or Fig. 97. Moreover the fertility-ratio (and thus the value of k) diminishes with increase of the sum of the corresponding age pairs (the age of maximum value having been passed). Obviously, also, k differs for various populations.<sup>2</sup> A rough general comparison of the Budapest (Körösi's) results for Budapest, and those for Australia is best indicated by shewing the position of the lines of "corresponding age-pairs" according to the value of the fertilityratio (birth-rate).

TABLE CXXX.—Comparison of Approximate Lines of Equal Fertility according to Pairs of Ages; Australia and Budapest.

N 7	Au	STRALIA	(Matern	ity rates	3).		BUDAPI	h rate).			
r Maternit z., ratio ol rr Cases of to Marrie 1 at risk.		f Equal	oint of I Fertility y = +	<b>.</b>	When	of	Egual	Point of Fertility y = +	<b>7.</b>	When $x = 0$	Reference letters.
Fertilityor Mattio, viz., Bartio, viz., Births (or Maternity)t Women	Angle	= 0	$\begin{array}{c cccc} \mathbf{x} = 0 & & & \\ \mathbf{v} = & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ &$		$\theta = \theta$	$= \theta \mid \text{Tangent} = k$		y = 0	Ä,		
Ferti Rati Biri Mate	Obsd.	Calc.	Obsd.	Calc.		Obsd.	Calc.	Obsd.	Calc.		
000 001 0.05 0.10 0.15 0.20 0.35 0.40 0.45	4.32 7.2 8.40 10.48 13.27 15.49 17.47 19.50 22.24 25.56	4.0 4.28 6.21 8.42 11.3 13.24 15.45 18.6 20.27 22.48 25.9	.0792 .1233 .1525 .1908 .2392 .2833 .3208 .3606 .4120 .4862 ?	.0781 .1113 .1530 .1953 .2382 .2820 .3269 .3729 .4204 .4695	Years 51.54 49.34 47.88 45.96 43.54 41.34 39.46 37.47 34.90 31.19 ?	10.23 14.56 18.26 23.52 29.54 35.52 40.48 45.0 48.30 52.42	9.0 9.58 13.53 18.46 23.39 28.32 33.25 38.18 43.11 48.4 52.57	.1833 .2667 .3333 .4425 .5750 .7228 .8632 1.0000 1.1301 1.3127 ?	.1757 .2472 .3398 .4379 .5437 .6598 .7898 .9385 1.1132 1.3246	Years. 55.5 55.5 55.5 55.5 55.5 55.5 55.5 7	st qr o.p mn kl ij gh ef cd ab

The two systems of lines are:-

For Australia;  $k_b (x + 50) + y = 55.5$ ; and

For Budapest;  $k_{b}(x + o) + y = 55.5$ .

<sup>1</sup> Or x + Ky = constant, see (576). Galton and Körösi's suggestion that k = 1 is an extremely improbable one, and is not borne out by the data, as Körösi's own results shew.

<sup>&</sup>lt;sup>2</sup> As already mentioned, the number of cases of maternity reviewed by Körösi was 46,926, occurring in the years 1889, 1890, 1891 and 1892, and these were attributable to 71,800 families according to the Census of 1st January, 1891, giving a rate of 16.339 per 100 families per annum over all. See p. 790, op. cit. The number is, of course, insufficient to determine the surface with great accuracy.

It would appear that the directions of these lines vary about equally for equal changes of rate since they are given by the formulæ.

(587). . 
$$\theta=4^{\circ}+47^{\circ}r$$
, for Australia ;  $\theta=9^{\circ}+97\frac{2}{3}^{\circ}r$  for Budapest.

These values are approximately correct for the regions within lines AB and AC on Figs. 96 and 97, but not outside those regions.

45. **Multiple Diisogeny.**—The equal frequency of twins, or of triplets, etc., according to pairs of ages may be called *multiple diisogeny*, the series of ages giving equal frequency being in this case also known as "corresponding pairs." The *twin digenous surface*, triplet digenous surface, etc., are the surfaces defined by the terminals of the z co-ordinates corresponding to the frequency of twins, triplets, etc., the x and y co-ordinates representing as before the ages of the husband and wife respectively.

In order that the results may be unequivocal, the ratios to be used should be those of the number of births "of at least n+1 children," to the number of births "of at least n children." That is, the ratio of twins should be to the cases of maternity; the ratio of triplets should be to the cases where there were at least twins; of quadruplets to at least triplets, and so on. Suppose in a population P there were:—

A' cases of maternity in which only one child was born;

and let A' + B' + C' + etc. = M, the total cases of maternity. Then the maternity ratio for the population is :—

$$(588)....m_1 = (A' + B' + C' + \text{etc.}) / P = M/P.$$

The twin ratio, so taken as to include all mothers who had at least two children at a birth, is:—

$$(589)....m_2 = (B' + C' + \text{etc.}) / M = B/M.$$

The triplet ratio, or that based on all mothers who had at least three children at a birth, is:—

$$(590)....m_3 = (C' + \text{etc.}) / (B' + C' + \text{etc.}) = C/B_1$$

and so on.

In this system we have:-

$$(591) \ldots m_1 = M/P \; ; \; m_1 m_2 = B/P \; ; \; m_1 m_2 m_3 = C/P \; ; \; \text{etc.} \; ;$$

that is, the population multiplied by the product of the ratios  $m_1 \,.\, m_2 \,.\,.\,.$   $m_n$  gives the number of women bearing at least n children. The ratio  $m_n$  is thus the relative frequency with which a woman—who in any child-birth has given birth to n children—will have given birth to the (n+1) child on the same occasion.

For the 9 years, 1907 to 1915, in Australia there were in all 1,042,588 cases of maternity; 10,630 cases of twins and triplets, and 100 cases of triplets: that is 1,031,858 single births, 10,530 cases of twins, and 100 cases of triplets. The ratios and their degree of fluctuation are shewn in the following table:—

Table CXXXI.—Shewing Frequency of Occurrence of Twins and Triplets (Nuptial and ex-Nuptial Cases combined). Australia, 1907-1915.

Year 1900.*	Cases of Matern- ity.	Twins including Triplets, etc.	Triplets.	Ratio of Twins to Cases of Maternity $m_2$	Ratio of Triplets to Cases of Twins. $m_3$	Ratio of Twins, 5 Year Average.	Ratio of Triplets, 5 Year Average.
-	100.905	1,042	13	.00953	.01247		_
7	109,305	1.065	6	.00963	.00563		
8			14	.01011	.01225	.00996	.01057
9	112,921	1,142			.01093	.01011	.01053
10	115,609	1,189	13	.01028			
11	120,957	1,236	14	.01022	.01132	.01021	.01034
12	131,726	1,350	16	.01025	.01185	.01024	.00946
13	134,343	1,369	8	.01019	.00584	.01031	.00870
14	136,576	1,406	11	.01029	.00782		_
15	133,444	1,417	10	.01062	.00706	-	
Totals	1,105,372	11,216	105	.01015	.00936	_	_

<sup>\* 1908-1914</sup> gave 0.010311 and 0.00931. See p. 314 herein.

The 5-year averages shew the regularity of the ratios, and justify the combination of the results of a series of years for the purpose of examining the characteristics of multiple diisogeny.

46. Twin and triplet frequency according to ages.—The data for determining the ratios  $m_2$  and  $m_3$  according to formulae (589) and (590) are given immediately by the records of births, and—unlike the maternity ratios  $m_1$ , formula (588)—are independent of the Census results. The

numbers of unspecified cases are negligibly small. There is some uncertainty in the numbers for ages 18 to 21 inclusive, owing to misstatements as to age. The following table, based upon 1,035,439 mothers, 10,533 twins, and 104 triplets, gives the available results for 9 years.

TABLE CXXXII.—Shewing the Frequency of Twins and Triplets in Cases of Maternity,\* according to the Age of the Mother and of the Father. Australia, 1907-1915.

Aget				AG	es of Mo	THERS.							
Groups.	Mothers Under 19	19	20	21-24	25-29	30–34	35–39	40–44	45–54	All Ages of Mothers.	25–39	Triplets÷ Twins 25–39	Triplets ÷ Twins All Ages.
Fathers Under 19	0;3 527 .0057	380								0; 11 907 .0121	••		
19-20	0; 11 2,413 ,0046	1,923	1,584	0;4 2,154 ,0002	335		••		::	0;37 8,409 .00440	335	·	:
21-24	0;33 7,985 .0041	9,439	12,159	54,749	15,413	1,630		 		9; 701 101,650 .00690	17,318	.0183	.0128
25-29	0;13 4,664 .0028	0;26 6,446 .0040	0;55 10,271 .0054	2;603 94,452 .00636	117,756		2,723	0; 5 287 .0174		17; 2,080 257,877 .00807	151,757	.01088	.0082
30-34	0;3 1,204 .0025	1,773	0; 18 3,355 .0054	3; 251 39,785 .00631	7; 928 103,618 .00895	5 ; 1,097 84,976 .01291	6;219 13,976 .0157	0 ; 19 1,263 .0150		21; 2,542 249,950 .01017	$\begin{array}{c} 18 \ ; \ 2.244 \\ 202.570 \\ .01108 \end{array}$	.00525 	.008 <b>3</b>
35-39	$\begin{smallmatrix}0;0\\407\\\cdots\end{smallmatrix}$	0;3 594 .0051	0;5 1,039 .0048	0;73 $12,564$ $.00581$	3 ; 446 46,867 .00951	7;905 72,990 .01240	10;838 54,557 .01536	3;67 5,707 .0117	$egin{array}{c} 0~;~2 \ 156 \ .0128 \end{array}$	194,881	174,414	.00548	.0098
20-44			0;4 643 .0062	0 ; 26 4,093 .0064	1;143 15,664 .00913	4; 429 35,051 .01224	5;752 48,109 .01563	$\begin{array}{c} 5;282 \\ 22,723 \\ .01241 \end{array}$	0;3 590 .0051	15; 1,639 126,873 .01292	98,824	.00831	.0092
45-49			0;3 218 .0138	0;9 1,379 .0065	2;58 5,516 .0105	$\begin{array}{c} 0~;~152 \\ 11,936 \\ .01274 \end{array}$	8;357 23,485 .01520	$2;229 \\ 19,418 \\ .0118$	0; 18 $2,703$ $.0067$	$12 ; 826 \\ 64,655 \\ .01278$		.0176 	.0145 
50-54				0;2 509 .0039	1;14 1,593 ,0087	$\substack{1\;;\;56\\3,639\\.0154}$	3;94 6,596 .0143	0;72 7,775 .0093	0; 14 $1,687$ $.0083$	5; 252 21,799 .01156	$\begin{array}{c} 5;164 \\ 11,828 \\ .01386 \end{array}$	.0304	.0198 
55~59	•••			 	${0;4}\atop 619\\.0064$	0;9 946 .0095	$^{1;22}_{1,837}_{.0120}$	$^{1;29}_{1,828}_{.0158}$	0;5 677 .0074	2;69 5,907 .01168	$egin{array}{c} 1~;~35 \ 3.402 \ .01028 \end{array}$	.0285 	.0289
60-64		••		••	${0;2}\atop{216}\atop{.0092}$	$\begin{array}{c} 0~;~6\\ 342\\.0175 \end{array}$	$\begin{array}{c} 0;5\\ 488\\ .0102 \end{array}$	$0; 8 \\ 540 \\ .0148$	$0;1 \\ 116 \\ .0086$	${0 \ ; \ 22} \ 1,702 \ .01292$	$\begin{array}{c} 0\;;\;13\\1,046\\.01242\end{array}$	.0000	.0000
6589	••	 	•••	• •		0;9 292 .0308	${0;6}\atop 536\atop .0112$	••	··· ···	$0; 15 \\ 828 \\ .01811$	$egin{array}{c} 0 \; ; \; 15 \ 828 \ .01811 \end{array}$	.0000	.0000
All ages of Fathers	, , , , , , , , , , , , , , , , , , ,	Í	1; 179 23,269	10; 1,334 20,685	23 ; 2,809 307,597	24 ; 2,953 233,080	35; 2,333 152,582	11; 711 59,541		1,025,439	All Triplets All Twins = .00988		.0099
	.có366	.00525	.00612 0:78	.00636 5 ; 927	.00913 17: 2.443	.01267	.01529	.01194	.00725 0; 2	.01017	= .00900	::	
25-39	0; 16 6,275 .0025	8,813 .0041	14,665	146,801 .00631	268,241 .00913	179,224 .01267	18 ; 1,091 71,256 .01531	3; 91 7,257 .01254	156 .0128			::	••
Triplets ÷Twins 25-39	.0000	.0000	.0000	.0054	.0063	.0079	.0164	.0329	.0000	• •			
Triplets ÷Twins All ages	.0000		į	.0075	.0082	.0081	.0150	.0155	.0000	.0099	of twins and		

<sup>\*</sup> The table shews for various age-groups of mothers and fathers the numbers of cases of maternity, and of twins and triplets occurring during a period of 9-years. The first number is the number of triplets; the second—divided from the first by a semi-colon—is the number of twins; the numbers beneath, viz., on the second lines are the "cases of maternity"; the numbers on the third lines are the ratio of the occurrences of twins to the cases of maternity. These ratios are calculated by the formula (589). † The ages are "ages last birthday."

An examination of the individual columns in the table for any given age-group of wives discloses the fact that there are no systematic differences for various ages of the husband. This is confirmed by the combination of the results for considerable groups. 1 The age of the husband, though it has an unmistakable influence on the maternity ratio, has no influence whatever on the twin-ratio. It is equally clear that the age of the wife is correlated with the frequency of twins.

The graph of the results indicates that the initial part of the curve (i.e., wives' ages up to 20 inclusive) does not conform to the general curve (owing perhaps to misstatements of age). The curve has a maximum at about  $37\frac{1}{2}$  years of age (i.e., age 37 last birthday), and is nearly a straight line almost up to the maximum value.

The following table gives the probabilities for the exact ages, not "age last birthday."

TABLE CXXXIII.—Shewing, according to Age of the Mother, the Relative Frequency with which at least a Second Child is Born.\* Australia, 1907-1915. Twin-ratios.

Age of Mother	Twin Ratio.	Age of Mother.	Twin Ratio.	Age of Mother.	Twin Ratio.	Age of Mother.	Twin Ratio.
11	.00100	22	.00605	33	.01299	44	.01070
12	.00137	23†	.00659	34	.01370	45	.00997
13	.00180	24	.00714	35	.01440	46	.00937
14	.00217	25	.00770	36	.01499	47	.00880
15	.00260	26	.00827	37	.01526	48	.00823
16	.00305	27	.00885	38	.01526	49	.00772
17	.00352	28	.00944	39†	.01502	50	.00725
18	.00400	29	.01007	40	.01470	51	.00680
19	.00449†	30	.01075	41	.01380	52	.00636
20	.00500 🐔	31	.01146	42	.01260	53	.00593
21	.00552	32	.01221	43	.01155	54	.00551
• 22	.00605	33	.01299	44	.01070	55	.00510

<sup>\*</sup> The table shews the ratio of cases of birth of two or more children to cases of maternity, the age being exact (i.e., not age last birthday).

† The ratios have been ascertained with great precision for all the ages from 23 to 39. Later they are less accurate, but the number of cases is relatively small.

<sup>1</sup> For example the following results were obtained:—

				AGES	or Wr	ves.			
AGES OF HUSBANDS.	Under 19.	19.	20.	21-24.	25–29.	30–34.	35-39.	40-44.	45-54.
Under 30	.0039	.0054	.0062	.0064	.0091	.0127	.0133	.0174	
25 to 39	.0025	.0041	.0053	.0063	.0091	.0127	.0153	.0124	.0128
All ages of husbands	.0037	.0053	.0061	.0064	.0091	.0127	.0153	.0119	.0073

These clearly establish the fact that the age of the husband has no influence whatever.

<sup>‡</sup> The ratios are somewhat uncertain owing to misstatements of age.

47. Apparent increase of frequency of twins with age of husbands.— If ages greater than 40 be left out of consideration, and the material for ages (wives and husbands respectively) of 25 to 39 years of age alone be embraced, the values of the twin-ratios according to the ages of husbands and wives are given approximately by the following expressions, viz.:—

$$(592)....m_2 = 0.0034 + 0.000228 \ x; \ m'_2 = -0.0076 + 0.00060 \ y.$$

These give the following results for husbands and wives respectively:—

Ages of Husbands Data Formula	19-20 .0059 .0080	21-24 .0095 .0086			35-39 .0125 .0120	.0134	.0139	50-54 .0139 .0154	55-59 .0103 .0165	65-89 .0181 .0188
Ages of Wives Data Formula	Under 19 .0025 .0038	19 .0041 .0041	20 .0053 .0047	21-24 .0063 .0062	25-29 .0091 .0089	30-34 .0127 .0119	35-39 .0153 .0149	40-44 .0125 .0179*	45-54 .0128 .0224*	

<sup>\*</sup> The straight line does not hold good for these ages.

This increase with the age of the husband is not, however, due to any influence the husband may be supposed to have upon multiple-births, but wholly to the fact of association in pairs according to age. The smaller coefficient 0.000228 (as compared with 0.000600) arises from the greater "spread" of the ages of the husbands. <sup>1</sup>

Although the attribution of the increased frequency with age to the husband is physiologically meaningless, nevertheless for rough estimates the method is valid, and so long as it is remembered that the effect is not due to increasing age of the husbands, there is no objection to this method of estimation.

48. **Triplet diisogeny.**—The numbers of triplets shewn on Table CXXXII. are quite insufficient to determine with any exactitude the digenous relations of triplets. The age-groups are too small. But if 30 be made a dividing age we get the following result:—

	Wi	ves.	Wives,						
Husbands.	Ages under 30.	Ages 30 & over.	Ages under 30.	Ages 30 & over					
Ages under 30	17; 2497 342650.	9 ; 335 25236.	.0068	.0269					
Ages 30 and over	17; 2011 241775.	61 ; 5603 424284.	.0084	.0109 .000144					
	Num	abers.	Ra	tios.					

<sup>&</sup>lt;sup>1</sup> If the ages were identical of husband and wife throughout, the maximum effect would be on a line making an angle of 45 degrees with either axis: consequently the ratio of multiple births if attributed to either sex would yield the same result.

As it has no influence on the occurrence of twins, it may be assumed as extremely unlikely that the age of the husband has any influence on the occurrence of triplets. This is confirmed by the above partitioning of the results, which shews opposite apparent influence. The results given in the final column of Table CXXXII. may therefore be taken as exhibiting the influence of the age of the wife. This influence can be expressed

$$(593)....m_3 = -0.0044 + 0.00047 y.$$

y being the exact age of the wife.

The results as ascertained from the data and as given by the formula are :—  $\,$ 

Age	 20	21-24	25-29	30-34	35–39	40-44	4549
Data Formula	 .0056 .0050	.0075 .0064	.0082 .0085	.0081	.0150 .0132	.0155 .0155	.0000

Having regard to the number of available cases it is certain that the frequency of triplets increases with the age of the wife. The rate of increase 0.00047 agrees well with that of the rate of increase 0.00060 in the case of twins. On plotting the results according to the age of the husband it was found that the points on the graph constituted a curve, not a straight line.

49. Frequency of twins according to age and according to order of confinement.—The relation between the frequency of the birth of twins according to age and according to order of confinement can be roughly seen from the results given hereunder. According to the order of confinement the frequency is very closely given by the equation:—

$$(594)....m'_2 = 0.0082 + 0.00114 n - 0.0000185 n^{2.5},$$

the calculated and observed results being respectively:—

			)	1	1				1		
Previous confinements Formula Data Corresponding age	0 .0083 .0082 26.78	1 .0094 .0096 28.25	$\begin{array}{c} 2 \\ .0105 \\ .0107 \\ 29.98 \end{array}$	.0117	.0124	.0130	.0134	7 .61§8 .0136 33.86	.0138	9 .0141 .0139 34.28	10 .0139 .0140 34.42

And if the age corresponding to these values be inserted from Table CXXXIII., the values on the final line are obtained.

50.—Unexplored elements of fecundity.—To distinguish between the effect of previous births and age upon the frequency of maternity, of twins, etc., more comprehensive data are required than at present exist for

Australia. The effect is one which, so far as the maternity-ratio is concerned, reflects social tradition in a larger measure than the physiological law; the latter is modified but not obliterated. In the case of twins, triplets, etc., the physiological laws doubtless alone operate.

The records necessary to ascertain the characteristics of digenous masculinity at birth exist for only two years, and disclose the fact that the variations according to age are too large to admit of satisfactory analysis, unless say 10 years' material is available.

Assertions from time to time have been made to the effect that the characteristics of first-born children are often sharply differentiated from those of later children. If in the record of cases of mortality the ages of father and mother were also given, and the order of the birth of the deceased, the data for the consideration of this question as regards length of life according to age and to place in order of birth would be available.

This question, however, belongs more properly to the subject of mortality, and will not be further considered in this monograph.

## XV.—MORTALITY.

- 1. General.—Human mortality may be considered statistically under two aspects, viz.,
  - (i.) A general one; that is, the aspect which has regard to the aggregate mortality from all causes of death; and
  - (ii.) A particular one; that is, the aspect which takes account of mortality from particular causes or by particular modes of death.

Both will be referred to.

Deaths from particular causes or by particular modes are, in general, functions both of age and time, i.e., an individual rate of mortality  $\mu'$ , viz., the ratio of the number of deaths D' from a particular cause to that part of the population P' subject to the risk of such death, is :—

$$(595).....\mu' = D' / P' = f(x, t)$$

x denoting age, and t time. It also varies with sex. In estimating the general rate of mortality it is convenient, although in many respects unsatisfactory, virtually to regard all persons in the population as equally subject to the risk of death from each cause 1: hence the general rate of mortality may be regarded—subject to some limitations—as made up of the sum of the supposititious rates  $\delta'$ ,  $\delta''$ , etc., from each cause; that is to say, the general rate of mortality is the ratio of total deaths during a unit of time to the total mean population, or algebraically:—

$$(596).....\delta = \delta' + \delta'' + ext{etc.} \equiv rac{D'}{P} + rac{D''}{P} + ext{etc.} = rac{D}{P}.$$

D=D'+D''+ etc., denotes the total deaths, and P the mean population during the unit of time in question. This rate is known as the crude death-rate, and is obviously inconsistent with (595). If the age-distributions of all populations were substantially identical, this method of evaluating the rate of mortality could be regarded, for many purposes, as fairly satisfactory. Inasmuch, however, as each particular rate,  $\mu$ , etc., is a special function of age, the general rate  $\delta$  is obviously also dependent upon the age and sex distribution. The distinction may thus be drawn between class mortality and general mortality, "class" denoting any section of the population, defined in any appropriate way.

<sup>&</sup>lt;sup>1</sup> For example:—Females only are liable to death from say misadventures in parturition, and that only between certain age-limits; and children are alone liable to death from diseases associated with dentition, etc., etc.

<sup>&</sup>lt;sup>2</sup> Throughout statistics conceptual precision has often to be sacrificed in order to express results simply, but the simplicity thus attained is usually more or less misleading.

Comparisons, the purpose of which is to measure, in a crude way, the virulence of the death-forces as between one population and another, may therefore be made on the basis of a common age and sex distribution, that is, the rates of mortality for each age or age-group, actually experienced by each population, may be applied to a "standard," or preferably to a "normal," population, the resulting totals giving the comparison required. That is to say, if the fact of variation with time (t) be ignored (though this variation will probably not be even approximately identical for any two populations), the quantity to be ascertained will be that indicated in (599) hereunder.

Let the proportion of the normal population between the ages x and x + dx be:—

(597).........
$$\eta_x dx = f_1(x) dx$$
, so that  $\int_0^\omega \eta_x dx = 1$ 

and let the instantaneous rate of mortality (the so-called "force of mortality") at age x be :—

(598) ......
$$\mu_x = {}_{1}f_{2}(x)$$
, and  ${}_{2}\mu_x = {}_{2}f_{2}(x)$ 

for populations 1 and 2 respectively; then adopting the same function (597) for both populations and applying (598) to each, we have :—

$$(599).....\mu'_{0} = \int_{0}^{\omega} (\mu_{x} \cdot \eta_{x}) dx \equiv \int_{0}^{\omega} \{f_{x}(x) \cdot f_{x}(x)\} dx;$$

with antecedent suffixes denoting whether the result applies to population 1 or 2.

These quantities may be called the *mortality-coefficients* of the respective populations, and generally they will differ somewhat from the "crude death-rates." If the age-distribution of a population happens to be sensibly identical with the "standard" or "normal" distribution, the mortality-coefficient would of course be sensibly the same as the crude death-rate"; and it might otherwise also agree with it, but only accidentally. For arithmetical convenience it is usual to compute an *index-of-mortality*, by attributing to "standard" or "normal" groups the death-rates actually experienced in the corresponding groups of the population under review.

The preceding rectification of the crude death-rate for the purpose of comparisons, is but one of the possible methods. Its significance depends virtually upon a common distribution of causes of death, these differing only in frequency of operation. If two countries had the same age-distribution, but one was characterised by violence of the diseases which caused mortality in the *earlier*, and the other by those which caused mortality in the *later* years of life, the results would differ even for the

same differences of rate in each disease, inasmuch as with the same rates the diseases characteristic of the earlier years of life levy a larger toll than those characteristic of later years. In short, the influence or "weight" of a cause of death varies, according to the relation of its incidence with age. Crude death-rates and the indexes of mortality are therefore both of restricted application, and need to be interpreted with full regard to their inherent limitations.

The frequency according to age of the occurrence of disease is very diverse, consequently in the aggregate of mortality from all causes the peculiar incidence of each is to a great extent masked; and as regards the secular trend of mortality the intervention of epidemics may produce great irregularities.

Many diseases have a well-defined annual period, while others have not; these periods, however, are not identical in phase. The aggregate of the deaths from all causes, therefore, gives a less definite indication of an annual period. Inasmuch as diversity of phase and of amplitude do not wholly obliterate the periodicity, the general death-rate, viz.,  $\delta = D/P$ , i.e., the deaths divided by the number of the population, is as follows:—

(600)... 
$$\delta = D/P = D f_1(t) \{1 + a_0 + \Sigma_{n=1} a_n \sin n (\theta + a_n)\} / \{P_0 f_2(t)\}$$

in which  $\theta$  is a fraction of a unit of time (say of a year), n=1,2,3, etc., and both  $D_0$  and  $P_0$  are means over a unit of time, as at a particular epoch. Thus the graph of a death-rate, extending over several units of time (years), is made up of a non-periodic curve—representing the general trend—upon which is superimposed a periodic curve repeating itself during each unit upon a scale varying with the death-rate itself. <sup>1</sup>

2. Secular changes in crude death-rates.—The general lowering of the general crude death-rate in the western world has been remarkable, and is best exhibited by deducing the general trend of the rates for each country. The death-rates for Australia are shewn in Table CXXXIV., from 1881 to 1915, for males, females, and persons; see columns (ii.) to (iv.). In order to partially eliminate the irregularities of results for single years, quinquennial means were formed, see columns (viii.) to (x.), and the smoothing of these for "persons" gives the values in column (xiv.), the maximum value 0.01570 being that for the year 1884 and the minimum 0.01066 that for the year 1911. This fall to about two-thirds of its earlier value in 27 years is remarkable, and is accounted for not only by a still greater decrease in infantile mortality, but also in general mortality up to 60 or 65 years of age. It is worthy of note that the year 1895 was characterised by a halt in the decrease exhibited by the general trend of the death-rate.

<sup>&</sup>lt;sup>1</sup> So long, of course, as the character of the periodicity is maintained.

The rates of infantile mortality are given in columns (v.) to (vii.), the quinquennial means in columns (xi.) to (xiii.), and the smoothed result or general trend in column (xv.). Here again the fall has not been continuous, see values for 1894-5. The character of the lowering of the rates does not therefore fall under any law susceptible of simple mathematical expression.

TABLE CXXXIV.—Shewing Secular Changes of the Death-rates, and of the Infantile Mortality-rates in Australia, from 1881 to 1915.

Year.		ath Ra 100,00		Infan Rate	tile Mor es × 10	tality ,000.	De	uennial ath Ra 100,00	Mean tes 0.	Quinq Rate Morta	uennial s of Inf lity ×	Mean antile 10,000.	General Trend of Death Rates (Smoothed) × 100,000.	General Trend of Infruite Mortility (Smoothed) × 10,000.
	Males.	Fe- males.	Per- sons.	Males.	Fe- males.	Per- sons.	Males.	Fe- males.	Per- sons.	Males.	Fe- males.	Per- sons.	Genera of Dear (Smc × 10	General Infutile (Smo × 1
(i.)	(ii.)	(iii.)	(iv.)	(v.)	(vi.)	(vii.)	(viii.)	(ix.)	(x.)	(xi.)	(xii.)	(xiii.)	(xiv.)	(xv.)
1881	1,589	1,328	1,469	1,232	1,095	1,165	1,636	1,348	1,504	1,372	1,203	1,293	1,528	1,293
1882	1,746	1,419	1,596	1,446	1,265	1,357	1,675	1,380	1,540	1,363	1,195	1,284	1,552	1,284
1883	1,654	1,381	1,529	1,302	1,138	1,222	1,708	1,404	1,569	1,353	1,186	1,274	1,569	1,272
1884	1,804	1,460	1,646	1,348	1,168	1,260	1,722	1,417	1,582	1,342	1,176	1,263	1,570	1,261
1885 1886 1887 1888 1889	1,747 1,659 1,583 1,589 1,672	1,434 1,392 1,317 1,300 1,385	1,604 1,537 1,461 1,456 1,540	1,360 1,348 1,235 1,251 1,400	$\substack{1,221\\1,189\\1,091\\1,072\\1,234}$	1,292 $1,271$ $1,164$ $1,164$ $1,319$	1,689 1,676 1,651 1,611 1,603	1,397 1,381 1,386 1,336 1,323	1,555 1,541 1,520 1,485 1,474	1,330 1,316 1,300 1,281 1,260	1,166 1,155 1,140 1,122 1,101	1,251 1,238 1,222 1,203 1,182	1,562 1,546 1,526 1,500 1,474	1,251 1,238 1,221 1,203 1,185
1890	1,554	1,287	1,431	1,152	1,009	1,082	1,570	1,289 $1,274$ $1,223$ $1,186$ $1,147$	1,440	1,237	1,078	1,159	1,444	1,163
1891	1,618	1,328	1,484	1,232	1,074	1,155	1,553		1,424	1,212	1,053	1,135	1,410	1,138
1892	1,419	1,144	1,291	1,142	970	1,058	1,496		1,369	1,188	1,024	1,108	1,368	1,112
1893	1,502	1,227	1,374	1,240	1,072	1,149	1,459		1,332	1,167	998	1,086	1,326	1,086
1894	1,386	1,128	1,266	1,107	952	1,031	1,419		1,292	1,158	993	1,076	1,292	1,074
1895	1,372	1,102	1,245	1,099	921	1,012	1,403	1,131	1,276	1,161	997	1,079	1,280	1,078
1896	1,414	1,135	1,283	1,202	1,045	1,126	1,411	1,139	1,285	1,177	1,012	1,096	1,282	1,096
1897	1,342	1,065	1,212	1,126	967	1,048	1,416	1,145	1,289	1,196	1,031	1,115	1,284	1,114
1898	1,540	1,267	1,412	1,364	1,175	1,272	1,404	1,130	1,275	1,204	1,038	1,125	1,283	1,125
1899	1,411	1,156	1,291	1,246	1,085	1,167	1,395	1,157	1,263	1,198	1,034	1,117	1,273	1,117
1900	1,314	1,026	1,178	1,086	915	1,002	1,403	1,123	1,270	1,181	1,019	1,097	1,255	1,097
1901	1,366	1,064	1,222	1,122	947	1,037	1,362	1,086	1,231	1,145	993	1,062	1,231	1,062
1902	1,383	1,102	1,249	1,142	997	1,071	1,322	1,052	1,194	1,103	••946	1,019	1,201	1,020
1903	1,837	1,080	1,215	1,183	1,025	1,105	1,302	1,037	1,176	1,053	892	970	1,172	971
1904	1,212	988	1,105	891	756	825	1,269	1,019	1,150	1 005	852	930	1,144	920
1905	1,214	950	1,088	906	724	818	1,235	994	1,120	952	800	878	1,118	872
1906	1,201	973	1,092	901	760	833	1,212	974	1,098	887	734	813	1,098	827
1907	1,211	977	1,099	884	734	811	1,200	957	1,084	867	711	791	1,085	792
1908	1,224	981	1,107	855	697	778	1,188	952	1,075	849	702	777	1,076	770
1909	1,151	906	1,033	787	642	716	1,184	<b>94</b> 6	1,070	820	671	748	1,070	751
1910 1911 1912 1913 1914	1,154 1,182 1,251 1,193 1,167	924 940 984 953 927	1,043 1,066 1,123 1,078 1,051	817 759 801 788 791	675 607 630 653 635	748 685 717 722 715	1,192 1,186 1,189 1,200	947 941 946 944	1,074 1,069 1,072 1,079	804 790 791 776	650 641 640 626	729 718 717 703	1,067 1,066 1,070 1,079	733 718 708 702
1915	1,208	916	1,066	743	605	675								••

The results in the above Table are shewn in Curves A and B of Fig. 98, the dots shewing the quinquennial means and the continuous line the general trend. The correlation between the two curves is fairly well indicated, because, although the ratio of the annual number of cases of deaths of children under 1 year of age, to the annual number of deaths of all ages is somewhat variable, there is some degree of general correspondence when a mean is taken over a number of years. See Fig. 98, p. 377.

The following example sufficiently illustrates the variable character of the ratio of infantile to total deaths, shewn in lines (a) and (b) hereunder:—

TABLE CXXXIV.A.—\*Ratio x 10,000, of Infantile to Total Deaths, according to Sex. Australia.

Year	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.
Males (a)	2,155	2,206	1,890	1,930	1,971	1,925	1,834	1,804	1,880	1,720	1,798	1,832	1,871	1,672
Females (b)	2,477	2,469	2,039	2,030	2,099	2,041	1,915	1,907	1,966	1,787	1,874	1,973	1,955	1,798
Females (c)	2,410	2,295	2,202	2,123	2,056	2,003	1,960	1,930	1,905	1,886	1,873	1,864	1,858	1,855
Males (d)	2,138	2,078	2,024	1,976	1,923	1,893	1,863	1,839	1,819	1,807	1,798	1,792	1,788	1,786
$(d)\div(c)=(e)$	.887	.905	.919	.931	.935	.945	.951	.953	.955	.958	.960	.961	.962	.963

<sup>\*</sup> The figures on lines (a) and (b) are the ratios of the annual numbers of male and of female infantile deaths to the annual number of total male and of total female deaths respectively. The figures on lines (c) and (d) are the smoothed ratios for females and males respectively. The figures on line (e) are the ratios of male to the female ratios as determined from the smoothed ratios (e) and (d).

Although the ratio oscillates between somewhat wide limits, the female ratio is invariably higher than the male-ratio: the general death-rate of females, however, is lower than that for males.

These results indicate that the proportion of infantile deaths to total deaths for both sexes is rapidly decreasing; the decrease for females being more rapid than for males. This is best seen by forming quinquennial means from which the general trend can be readily ascertained. The magnitude and general trend of the ratios of infantile to total mortality in the case of females and also in the case of males, are shewn respectively by curves M and N in Fig. 98, p. 377.

3. Secular changes in mortality according to age.—The death-rate for any age-group is the ratio of the number of deaths per unit of time (per annum) therein to the average number of persons in the group during that unit, *i.e.*, to the number at risk.<sup>1</sup> This ratio is markedly different for the two sexes. The following table, viz., CXXXV., based upon the censal results and intercensal experience since 1881 <sup>2</sup>, shews that for nearly all ages a remarkable diminution in the death rates has taken place. That this must be so is obvious from the results given in Table CXXXIV.

In a later Table, viz., CXXXVI., the average, also according to age, of the ratios between the death-rates of the sexes is given. These average ratios are the ratios of the sum of the four ratios given in each age-group for females to those given for males, and may be referred to the epoch 1900.0 for all comparisons as to any possible change with time.

<sup>&</sup>lt;sup>1</sup> Actuarially, the ratio of the number of deaths experienced by persons between given limits of age to the total number of units of time (years of life) lived within those age-limits by the population considered.

<sup>&</sup>lt;sup>2</sup> The results for 1911 are really based upon the deaths occurring during the nine years 1907 to 1915 inclusive. The actual populations for these years are assumed to be distributed according to age as at the Census of the middle year, viz., 1911, which must be substantially correct.

It is obvious from the table that estimations of the frequency of death based upon tables compiled on the experience of past years are erroneous, if applied at the present time. 3 We shall investigate hereinafter the law of change.

TABLE CXXXV.—Shewing the Mean Death-rates in Age-groups deduced for Various Epochs, and Illustrating their Secular Changes. Australia, 1881 to 1915.

Age or	MA	LES. RAT	TE × 100	,000.	FEM.	ALES. RA	ATE × 10	0,000.	Femal	ge ratio of e to Male h Rate.
Age-	1881- 1891, say 1886.0	1891- 1901, say 1896.0	1901- 1911, say 1906.0	1907- 1915, say 1911.0	1881- 1891, say 1886.0	1891– 1901, say 1896.0	1901- 1911, say 1906.0	1907- 1915, say 1911.0	Age.	Data. Sm'thed result.
0-0* 0 1 2 3 4 4 0-4† 5-9 10-14 15-19 20-24 25-29 30-34 35-39 40-44 45-49† 50-54 60-64 65-69 70-74 80-84 85-89 90-94 95-99 100-4	14,366 3,576 1,379 891 692	23,473 12,738 2,685 982 628 497 3,777 310 219 366 541 651 787 902 1,311 7,787 2,454 3,624 7,104 5,207 7,104 26,917 37,504	19,341 10,112 1,804 677 441 350 2,801 222 192 300 410 473 552 714 918 1,222 2,091 3,095 4,708 4,708 4,708 11,845 16,450 27,372 27,372 36,974	16,360 8,540 1,559 642 409 301 2,455 222 173 256 364 481 1,120 1,511 2,153 3,174 4,678 6,972 10,900 16,815 26,783 30,896 39,111 118,041	21,340 12,414 3,427 1,336 648 4,035 355 406 597 781 1,262 1,262 1,262 4,423 6,218 10,076 14,490 24,227 28,455 32,207	19,333 10,786 2,519 963 617 488 3,276 293 192 315 447 586 586 703 847 1,703 2,677 3,753 5,704 9,967 13,984 21,960 22,6497 45,941 47,312	15,562 8,349 1,684 631 412 325 2,365 201 171 272 370 468 468 890 1,044 1,497 2,293 3,619 6,074 9,074 12,293 3,619 6,074 1,293 3,619 6,074 1,293 3,619 6,074 1,293 3,619 6,074 1,293 3,619 6,074 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2.5 2.5 4.5 27.5 12.5 27.5 27.5 27.5 27.5 27.5 27.5 27.5 2	\$.1866 .8395 .9371 .9524 .9477 .9571 .8614 .9236 .8973 .8372 .8326 .9349 .9416 .9374 .8253 .7525 .7199 .8768 .8704 .8427 .7587 .8069 .8704 .8427 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 .8428 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<sup>\*</sup> Nominally at the instant of birth, but not really so. For the first week after birth the curve is quite distinct from the general death-rate curve after that period. The values given are deduced from the results for the five age-groups, 0 to 4 inclusive, by formula (197), p.68 herein. If computed on the basis of  $\mu=A+Cx+Bc^{\circ}$ , see C. H. Wickens' Journ. Austr. Assoc. Adv. Sci. XIV., 1913, p. 535. The values for 0 will be 27640, .26330, .22790, .19460 and .22740, .21470, .17840 and .15090. But true values of  $\mu_0$  are really much greater than these. † Between these limits (inclusive) the ratio is 0.8593. 
‡ The ratio of death-rates using .27640 + etc., to .22740 + etc., is 0.8017.

4. The changes in the ratio of female to male mortality according to time and age.—The ratio of female to male mortality, according to time, may be deduced from the rates given in Table CXXXIV., and those according to age from the rates given in Table CXXXV.

To avoid the irregularities of individual years the former ratio is obtained by dividing the results in column (ix.) by those in column (viii.), Table CXXXIV. The quotients are given in Table CXXXVI., and are shewn by the dots on curve C, Fig. 98. This is the ratio for general mortality. For infantile mortality the results in column (xii.) of Table CXXXIV. are divided by those of column (xi.), and these are shewn by

<sup>3</sup> Thus the actuarial tables used by insurance societies err on the side of conservatism; they are based upon death-rates which are now excessively high.

small crosses on curve D, Fig. 98. The firm lines denote the general trend of these results. They give some indication of correlation with the general and infantile death-rates, see Curves A and B, and the difference between the two curves is less marked; see Fig. 98, p. 377.

TABLE CXXXVI.—Shewing Ratios of Female to Male Death-rates, and Female to Male Rates of Infantile Mortality. Based upon Quinquennial Means. Australia, 1881-1913.

Year of De-	Ratios	of Female Rates (	to Male l Curve C).		Ratios of Female to Male Rates of Infantile Mortality (Curve D).						
cade.	1880.	1890.	1900.	1910.	1880.	1890.	1900.	1910.			
0		.821	.800	.795		.872	.863	.809			
1	.824	.820	.797	.793	.877	.869	.867	.811			
2	.824	.818	.796	.796	.877	.862	.858	.809			
$\frac{2}{3}$	.822	.813	.796	.788	.876	.855	.847	.807			
4	.823	.808	.803		.876	.858	.848				
5	.827	.803	.805	'	.877	.859	.840				
6	.824	.807	.804		.878	.860	.828	• • •			
7	.840	.809	.797		.877	.862	.820				
8	829	.805	.801		.876	.862	.829				
9	.825	.829	.799		.874	.863	.818				
*2.0				7925				.8089			
*2.5		.8160	.7986		.8766	.8630	.8565				
*3.0	.8232	.5100									
*7.5	.8290	.8112	.8013		.8762	.8611	.8270				

<sup>\*</sup> These are means of five quinquennial means, except in two instances where they are means of four quinquennial means.

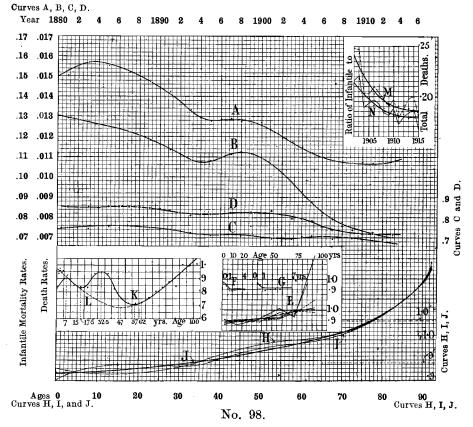
That the ratio of female to male mortality varies with time, having changed from 0.824 in 1881 to 0.788 in 1913, shews that life-tables for males and females, based on experience dating many years back, can no longer represent the facts with sufficient exactitude.

The curve, shewing the ratio of female to male mortality according to age, may be deduced from Table CXXXV., and in view of the overlap or the partial overlap of the 1907-15 results on those of 1901-11, the epoch to which the ratio may be referred is 1900. These ratios are based upon the sums of the four ratios for each sex, given in the table. The result is shewn in Fig. 98, curve K. There are two maxima and two minima in the curve, at the ages indicated in the table; see p. 377.

The dotted curve L, from which the curve K departs during the reproductive period of life, is symmetrical about an axis passing through the age 47. It is not unlikely that this departure from the curve L is due to the vicissitudes of reproduction; see the reference hereinafter to the gestate force of mortality.

<sup>&</sup>lt;sup>1</sup> Though not strictly exact, this assumption is sensibly correct.

## Mortality Curves and their Relations. Australia.



Curve A shews the trend of the quinquennial means of the annual death-rates for "persons" from 1880 to 1913 for the Commonwealth of Australia: the dots shew the quinquennial means themselves; see Table CXXXIV., p. 373.

Curve B similarly shews the trend of the quinquennial means of the infantile mortality rates: the dots shewing, as before, the quinquennial means; see Table CXXXIV., p. 373.

Curve C.—The dots shew the ratios of the quinquennial means of the death-rates for females to the quinquennial means of the death-rates for males, and the continuous line shews the general trend of these results; see Columns viii. and ix. of Table CXXXIV., p. 373.

Curve D.—The minute crosses shew the ratios of the quinquennial means of the rates of female infantile mortality to the quinquennial means of the rates of male infantile mortality, and the continuous line shews the general trend of these results; see columns xi. and xii. of Table CXXXIV., p. 373.

Curves E.—The firm lines are the graphs for males and the broken line the graphs for females, of the results given in the vertical columns of the lower part of Table CXXXVII., p. 379.

Curves F. shew the changes in the ratios of decrease of mortality for ages 0 to 4, the firm line indicating the results for males and the broken line those for females; see pp. 378-380.

Curve G shews the mean of the results for ages 0 to 4, so reduced that the mean agrees with curve J; see pp. 379-380.

Curve J may be regarded as the corresponding line for "persons." The scale needs modification. The line denoting unity may be taken at 0.9547: thus 0.9' and 1.0 are the correct places for 0.9 and 1.0 in relation to the curve; see p. 380.

Curve L may be regarded as the corresponding line for "persons." The scale needs modification. The line denoting unity may be taken at 0.9547: thus 0.9' and 1.0 are the correct places for 0.9 and 1.0 in relation to the curve; see p. 380.

Curve L may be regarded as the corresponding line for "persons." The scale needs modification of the decrease of fema

TABLE CXXXVII.—Shewing for the Period of 1881 to 1915 the Average Ratio of Female to Male Mortality, according to Age. Australia.

		D	ATA.			SMOOTHED RESULT.										
•	Ratio	1	Ratio	A	Ratio	atio AVERAGE RATIOS OF FEMALES TO MALE DEATH-RATES										
Age- group.	1000	Age- group.	1000	Age- group.	× 1000	Age.	Ratio×	1000	Age.	Ratio	× 1000	Age.	Ratio	× <b>1</b> 000		
	017	15.00	007	05 50	759	0.0	817	(a)	35.0	944	(a)	70.0	773	(a)		
$0.0 \\ 0-1$	817 840	$15-20 \\ 20-25$	837 833	65-70 70-75	807	5.0	894	927	40.0	882	693	75.0	810	810*		
1-2	937	25-30	935	75-80	835	7.0	903†	9.09	45.0	787	682	80.0	850	8 5 O*		
$\bar{2} - \bar{3}$	952	30-35	942	80-85	870	10.0	883*	883*	47.0	753	660‡	85.0	892	892*		
$\bar{3}_{-4}$	948	35-40	937	85-90	843	15.0	836*	8 3 6*	50.0	730	683	90.0	935	935*		
$4-\bar{5}$	957	40-45	823	90-95	1.003	17.5	8341	819	55.0	713	605	95.0	980	980#		
5-year		20 20		İ		ļ	1 1			i i						
means		45-50	753	95-100			839	802	57.0	710	702	100.0		1028*		
0-5	861	50-55	720	100-105	1.007	25.0	894	767	60.0	716	715	102.0	1044	1044*		
5-10		55-60	716			30.0	944	738	62.0	724*	7 2 4*					
10-15		60-65	723			32.5	950†	7 2 2	65.0	741*	741*	j				
15-20	837	65 - 70	759			35.0	944	710	70.0	773*	810*		• • •			

5. Secular changes in mortality vary with age.—For any age or group of ages, let  $\mu_0$  denote the mortality at a particular date, adopted as time origin; and let  $\rho$  denote its rate of change—the sign being negative if it be decreasing—so that

$$(601).....\mu_t = \mu_0 e^{\rho t} = \mu_0 e^{\phi(t)t}.$$

The last form is necessary only if  $\rho$  be not constant. It will be found probably in all cases that  $\rho$  is a function of time, and it is also a function of age. The results for small age-groups are of course irregular, so that it is only in extended age-groups that the laws of the secular changes according to age and time are rendered obvious and unequivocal. This can be seen by an analysis of the results given in Table CXXXV.,1 and it is important to know whether for any given age  $\rho$  is sensibly constant for any sensible period.

The analysis is effected by forming a series of sums of age-groupresults from Table CXXXV., and calculating the coefficients which, multiplied into the results of any period will give those of a later period.

Females(e)  $10636 \times .7909 = .08412 \times .7909 = .06659 \times \sqrt{(.7909)} = .05922$  Computed The constant ratios .8050 and .7909 therefore reproduce the results fairly well, for males and females respectively, though with a decennium as unit for the ratio-value, we find the value of the ratio is  $_{10}\rho = 0.8052 - 0.000127t - 0.0001573t^2$  for females, t being expressed in years reckoned from 1886.0. The results are computed by taking the square root of the quantities .8314 and .7928 : allowing each the weight 2 and .9016 =  $\sqrt{(.8219)}$  the weight 1. This gives 0.89723, the square of which is .8050. The factors to divide into .12101, .09843, etc., are respectively 1, .8050, .64802 and .58142; the division gives .12101, .12227, .12043 and .12101 the mean of all being .12118 from which by inverting the procedure the above values for males are deduced; similar results give .10636, etc., for females.

The values, found as shewn, suggest that, for the purpose of obtaining values for successive dates, multiplication by a factor and its powers, or say an annual quinquennial or decennial coefficient of variation, has advantages over the employment of differences.

<sup>\*</sup> Curve of ratios identical with curve L in Fig. 98, shewn by broken lines.
† Maximum values. ‡ Minimum values.
(a) Columns (a) are the values to curve L shewn by broken lines in Fig. 98. This curve is symmetrically situated about an axis, passing through the axis of abscissæ at age 47.0. For the significance of curve L reference should be made to the text.

<sup>1</sup> For example the sum of the rates 0 to 49 gave the following indication:—

The quantities in columns ii. to iv., and vii. to ix., of this table, for males and females respectively, are deduced for the corresponding series of agegroups shewn; the ratios are assumed to be true for the centres of the ranges of ages, an assumption which is sufficiently exact for the purpose in view.1

TABLE CXXXVIII.—Shewing the Changing Ratios for different age-groups as between different dates. Australia, 1881 to 1915.

	_						02 00	LUIU.		
			MALES	<b>3.</b>			F	EMALE	s.	
AGE GROUPS	1886 to 1896	1896 to 1906.	1906 to 1911.	Means	Ratio to Total,	1886 to 1896.	1896 to 1906.	1906 to 1911,	Means	Ratio to Total.
(i.) 00 1 2 3 4 Means	.9416 <sup>2</sup> .8665 <sup>2</sup> .8439 <sup>2</sup> .8395 <sup>2</sup> .8469 <sup>2</sup>	$ \begin{array}{r} .8310^{2} \\ .8197^{2} \\ .8182^{2} \\ .8380^{2} \end{array} $	.8445 .8642 .9480 .9274	(v.) .9165 .9019 .8473 .8544 .8565 .8464 .8705	(vi.) 1.0528 1.0361 .9733 .9815 .9838 .9723 1.0000	(vii.) .9518 <sup>2</sup> .9321 <sup>2</sup> .8573 <sup>2</sup> .8490 <sup>2</sup> .8601 <sup>2</sup> .8678 <sup>2</sup>	(viii.) .8972 <sup>2</sup> .8798 <sup>2</sup> .8175 <sup>2</sup> .8094 <sup>2</sup> .8171 <sup>2</sup> .8161 <sup>2</sup>	.8219 .8248 .9112 .9272	(x.) .9050 .8891 .8349 .8456 .8563 .8582 .8649	(xi.) 1.0474 1.0291 .9654 .9777 .9901 .9923 1.0000
$\begin{array}{c} 0-4 \\ [5-14] \\ [14-24] \\ 5-24 \\ 25-49 \\ 50-64 \\ 65-79 \\ 80-104 \\ \end{array}$ Means	$     \begin{array}{r}       .9113^{2} \\       .8286^{2} \\       .8564^{2} \\       .9098^{2} \\       .9530^{2} \\       .9838^{2} \\       1.0366^{2} \\       .9418 $	$igg  .8847^2 \\ .8848^2 \\ .8847^2 \\ .9153^2 \\ .9265^2 \\ 1.0029^3 \\ 1.0054^2 \\ .9327$	.9541 .8732 .9030 .9193 1.0194 .9343 2.5304 1.0305	.8843 [.9092] [.8600] .8770 .9139 .9557 .9815 1.1229 .95588	.9251 .9175 .9561 .9998 1.0268 1.1747 =1.0000	.9011 <sup>2</sup> .9067 <sup>2</sup> .8716 <sup>2</sup> .8858 <sup>2</sup> .8983 <sup>2</sup> .9548 <sup>2</sup> .9683 <sup>2</sup> 1.1481 <sup>2</sup> .9592	.9018 <sup>2</sup> .9138 <sup>2</sup> .9174 <sup>2</sup> .9909 <sup>2</sup> .9680 <sup>2</sup>	.9543 .8754 .9043 .8827 .9723 .9520 1.4448 1.0019	.8714 [.9038] [.8908] .8955 .9014 .9433 .9741 1.1354 .95351	.9138  .9392 .9453 .9893 1.0216 1.1908 =1.0000

The quantities shewn in the table for the 10-year intervals are the square roots of the quantities originally given. In the totals these are counted twice. In the means 1 denotes the arithmetical mean, 2 the mean of the squares.

The irregularities of the results are doubtless due in part to actual irregularities in the death-rates themselves, and in part to errors in the data. They shew unmistakeably that the death-rate up to age say 60 decreases with time, and that, at any rate above age 80, the rate for males increases with time. The results exhibiting this are illustrated by curves E, F, G, H and I, Fig. 98, E shewing the six results given in Table CXXXVIII., for males by firm lines, and the six results for females by broken lines. The thick line divides the values under unity, viz., those

$$(a) \ldots (\frac{1}{n} \Sigma a) / (\frac{1}{n} \Sigma A) \equiv a_m / A_m = a_0 / A_0$$

where  $a_0$  and  $A_0$  are the values for the middle range, the suffix notation being -k, . . . . -1, 0, 1 . . . . k. Obviously in general such an assumption is invalid; the true range is that which gives a value of a' / A' equal to  $a_m$  /  $a_m$ . Later the assumption will also be made that the mean of a series of ratios may also be ascribed to mid-point of the entire range. The error of such an assumption is best illustrated by setting out the two results thus:—

$$(\beta) \cdot \cdot \rho_m = (\rho_1 + \rho_2 + \dots + \rho_n)/n \equiv \left(\frac{a_1}{A_1} + \frac{a_2}{A_2} + \dots + \frac{a_n}{A_n}\right)/n$$

$$(\gamma) \cdot \dots \cdot \rho'_m = \frac{a_1 + a_2 + \dots + a_n}{A_1 + A_2 + \dots + A_n} \equiv \left(\frac{a_1}{A_m} + \frac{a_2}{A_m} + \dots + \frac{a_n}{A_m}\right)/n$$

$$(\gamma) \cdot \dots \cdot \rho'_m = \frac{a_1 + a_2 + \dots + a_n}{A_1 + A_2 + \dots + A_n} \equiv \left(\frac{a_1}{A_m} + \frac{a_2}{A_m} + \dots + \frac{a_n}{A_m}\right) / n$$

Although in general  $\rho'_m$  is not equal to  $\rho_m$ , if the successive ratios are in arithmetical progression, they are in agreement, and  $\rho_m = a_m/A_m$  above. If these successions of ratios are sensibly linear in their changes, the error will be negligible.

Let a series of quantities, a and A, be respectively the numerators and denominators which give the ratio for any range of the variable. Then it is assumed

which represent a decrease, from those which represent an increase (on the upper side). It would appear from this figure that the change is somewhere between 70 and 80, and that the rate of decrease of mortality unmistakably diminishes as age increases.

Curve G shews the mean of the results multiplied by a factor so as to make the average agree with curve J. Curves F shew the changes in the ratios of decrease for ages 0 to 4, the firm line denoting the results for males and the broken line those for females. Curves H and I are drawn through the ratios, to the total, of the means of the factors of decrease (or increase): they illustrate the general correspondence in the male and female cases of the effect of age, the curve J being the probable general indication, *i.e.*, for persons. The line denoting unity may be taken as at 0.9547: thus the broken line at 1.0474 will be really unity in relation to the curve.<sup>1</sup>

It is obvious that advances in hygiene, therapeutics, and social condition will be marked by diminished mortality. Whether that will extend over all ages or will characterise all but the older ages, depends upon whether the term of life is virtually sharply fixed or not. We shall consider the matter further in a later section.

6. Fluent life-tables.—For many purposes (much of insurance business for example) the ordinary tables of rates of mortality  $(\mu_x \text{ or } m_x)$ , of probabilities of living or dying within a year  $(p_x \text{ or } q_x)$ , or of expectations of life  $(\stackrel{\circ}{e_x})$ , of the population survivors  $(l_x)$ , at age x, etc., are satisfactory because they represent not only a considerable body of past experience, but also are 'on the safe side' for the major part of the uses to which they are applied (determination of insurance premiums, etc.). For the accurate prediction of life, however, existing tables are not at all satisfactory, because, representing past experience, they take no account of the fact that the rates of mortality for the major part of life are rapidly diminishing, that is the probability of life is increasing for every age, say up to 60 for both sexes in many and probably in all, civilised countries. Hence for estimations of the true probability of life, for the evaluation of payments for annuities, etc., existing life-tables are seriously defective.

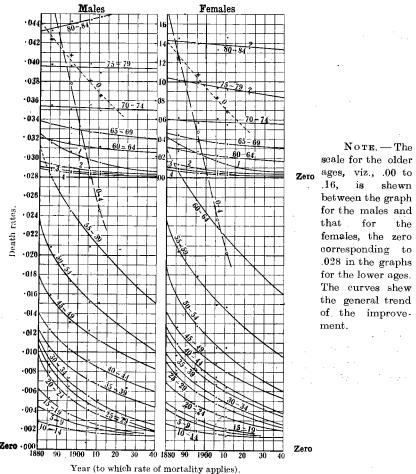
To avoid this difficulty it is necessary to construct fluent life-tables, extrapolated for as many years as may seem safe. Such tables are, to the extent they are extrapolated, prediction tables. In these, past experience is brought under review in two ways: that is (a) as to the values of the various functions as they existed at a given moment, and (b) their trend, or variation with time. As the variation with time is not linear probably an annual coefficient of variation would best attain the object in view, and could be readily applied.<sup>2</sup>

<sup>1</sup> Any resulting "error of scale" may almost be ignored.

<sup>&</sup>lt;sup>2</sup> Thus if this were 0.993 for example, the values of the factors for successive years would be —to three decimals—0.993, 0.986, 0.979, 0.972 . . .0.9454, the last being for the 8th year forward. A linear diminution of .007 would have given .9444.

It is only by means of fluent life-tables that accurate predictions of survivors for any given age can be ascertained. In Fig. 99, shewing the change of death-rates with time, the dots denote the values according to the data: the system of curved lines shews what may be regarded as the general trend of the mortality-rate for the various age-groups. The results for individual age-groups are irregular, but they unmistakably point to a diminution of the type  $e^{-mt}$ , where t denotes the period elapsed, m however having a different value for each age and sex. This index factor (m) has no simple relation to age or to the magnitude of the mortality-rate itself, but is probably related to the two combined; that is, it is a function of  $\mu$  and  $\mu$ . We shall first deal with the method of evaluating it, and it will simplify the matter if  $\mu$  be not treated as a function of time as in the final form of (601).

Change of Rates of Mortality according to Age and Time.



The dots shew the rates of mortality according to the data; the curved lines denote the general trend. The scale of the upper part of the graphs is shewn in the middle, the divisions representing ten times as great a quantity as in the lower part. The extrapolation of the curves to the year 1940 give an indication of the continuation of the improvement.

Fig. 99.

7. Determination of the general trend of the secular changes in mortality.—The results given in Table CXXXV., shewing a decrease with time—except for very great ages—in the rates of mortality, are best studied in Fig. 99. As this figure, however, gives only the rates of mortality as ordinates, and the epochs to which they refer as abscissæ; and does not shew the ratio of the improvement, it is necessary to evaluate this ratio. To do this the mortality at any epoch must be divided by that at some epoch of reference. Thus we may assume—see Fig. 99—that over greater or lesser stretches of time, the curve of variation of the mortality is of the form (601) with m constant; that is:—

$$(602)\ldots \mu_t = \mu_0 e^{rt}$$
; hence  $\log \mu_t = \log \mu_0 + rt \log e$ 

The logarithmic homologue of this relation being a straight line, as shewn, the values of  $\mu_0$  and r may be found by the "method of least squares." Or, put  $R_t = \mu_t / \mu_0$ ; then, reckoning t from the year for which  $\mu_0$  is taken, the general trend of the change in mortality can be computed by the following formulæ, the derivation of which from (602) is obvious.

(603).....
$$r' \log e = \frac{1}{n} \left( \frac{\log R_1}{t_1} + \frac{\log R_2}{t_2} + \text{etc.} \right)$$

In this expression n is one less than the number of dates for which  $\mu$  is known: r' is, of course, the mean value of r. Having found r' log e the mean initial value of the rate of mortality is:—

(604). 
$$\log \mu'_{0} = \{\log \mu_{0} + \log \mu_{1} + \log \mu_{2} + \ldots - r' \log e (t_{1} + t_{2} + \ldots)\} / (n+1)$$

and  $\mu'_0$  is the mean value to be substituted for the original  $\mu_0$  to compute later rates; that is, the general trend may then be taken as  $\mu'_t = \mu'_0 (e^{r'})^t$  the value of  $e^{r'}$  being determined according to the unit of t (i.e., for a year, a quinquennium, a decennium, etc.).

Within what limits an assumption of the relation expressed by (602) may be supposed to exist is of course to be ascertained by graphing the results on a suitable scale.

8. Modification of the general trend by age.—In order to discover the relation between age and the present secular improvement in mortality, it will suffice to take the terminal values only into account; provided we restrict ourselves to the most consistent results. The improvement for 25 years has therefore been computed, and is as follows, the tabulated results being the values of  $\mu_{25}$  /  $\mu_0$ :—

<sup>&</sup>lt;sup>1</sup> The following instance will suffice to disclose the significance of the method :-Sum of Squares 1911 Year 1886 1896 1906 .00642of residuals. Date .01379 .00982.00677 .01379 .01016 .00748 .00642.00602.01386.00993.00711.0000006200000. .00034+.00071..+.00007 + .00011 + .00034 - .00040.00000029The values of  $e^{rt}$  for a unit of 5 years, by (b), i.e., adopting terminal values 0.8582: by (o), i.e., by above method 0.8463.

TABLE CXXXIX.—Shewing the secular improvement for 25 years in the Rates of Mortality. Australia, 1886-1911.

$\mathbf{A}_{\mathbf{g}}$	e l	2	3	4	7.5	12.5	17.5	22.5	42.5	47.5	67.5
Females .	405	.430	.458	.463	.544 .533 1.021	.651	.544	.459 .571 .804	.680 .588 1.157	.704 .629 1.119	.846 .785 1.078

\* Ratio of male to female ratio of improvement. The smaller the ratio the greater the diminution of the mortality.

These results show (i.), that in general the diminution of mortality is more marked in young life than in old; and (ii.), that the diminution is not identical for males and females.

Changes in rates of mortality, whether due to causes outside human control or otherwise, may be regarded as due to changes in the relation between the human organism and its environment. Factors known to be operative in various organisms, and which are possibly operative in the human case, are:—

- (i.) Evolution of the protective reaction between the organism and its environment.
- (ii.) Changes of the food supply in amount and quality.
- (iii.) Changes due to the reactions of the organism to economic conditions, in respect of its nutritional and neural apparatus, etc.
- (iv.) Changes in individual and general hygiene, in therapeutical and surgical knowledge, and in prevailing traditions which affect the vitality of the organism; etc.

For our present purpose it is not material whether the change is what may be called internal—as (i.) above— or external: either or both may be regarded as changes in environment, i.e., provided they are regarded as either actual or virtual changes. In short, the effect upon the death and morbidity rates, of any given change in human environment, necessarily varies with the modifiability or "plasticity" of the human organism. The plasticity, however, is not the only element which influences the results. The rate of a general improvement in environment will probably be masked to some extent by evolutionary disturbances, as, for example, by dentitional and puberal changes and, in the case of females, by the demands made on the organism by the exercise of the reproductive function. Hence, a priori, it is not to be expected that the secular variation of mortality according to age will reveal any simple progression with age. Moreover, to maintain the same rate of improvement for the ages of least mortality, as for those of greater mortality, is probably, from the nature of the case, very difficult.

Let  $R_x$  denote the ratio of change in  $\mu_x$  in a given unit of time; R being supposed to vary only with age (x). Excepting at the age of minimum mortality, a given value of  $\mu$  is characteristic of two ages, viz., one less and the other greater than this minimum age. Since the *plasticity* 

of the  $organism^1$  diminishes with age, a given (absolute) change in environment will tend to have less effect on the later than on the earlier age, other things being equal. It follows, therefore, that, in so far as plasticity alone is concerned,  $R_x$  will be greater than  $R_{x+k}$ . If the plasticity degrade continuously with age we may suppose that it could be expected to vary probably either as  $1/(x+a)^{b+cx}$  or else as  $1/e^{ax^b}$ , the value of a in the former representing the interval between fertilisation and birth, or say 0.75 year, since the plasticity is initially a maximum, and is greatest in utero. Consequently if it were necessary to take plasticity alone into account the reciprocal of the last quantity should be a factor distinguishing between the equal values of  $\mu$  for different ages. The former expression, it is found, does not represent the facts; the latter possibly would do so For the purpose but for the other elements influencing the result. of analysing these complex relations between age, the change in the rate of mortality, and the magnitude of that rate, we shall make use of the Census Life Tables for Australia for 1881-1890, and 1901-1910, see Census Report, Vol. III., pp. 1209-1218. For exact ages 0 and 1, the ratios of  $\mu_x$  are used, and for the purpose in hand it will be abundantly accurate to take  $\mu_x=rac{1}{2}\left(m_{x^{-1}}+m_x
ight)$  for ages 2 and above 2,2 m being the central deathrate for each age in question. In order to fix upon values of the mortality with which to associate the ages and ratios of change, the geometric means of the mortalities used in computing the ratios have been adopted, which is consistent with the first form of formula (601). It will also be assumed that the tabular values may be referred to the central point of time of the period from which the data are derived.3

As already defined,  $R_t$  denotes the ratio of change for the time, that is  $R_t = \mu_t / \mu_0$  as before, see formula (603). But there will be some advantage in fixing our attention upon the ratio of improvement rather than upon the ratio of reduction of mortality. Thus if there be no improvement (diminution) in the death-rate with the lapse of time, the quantity considered should be 0, and on the other hand the vanishing of death altogether would be denoted by unity. Let B denote this ratio of betterment (or of improvement), then :—

$$(605)..._0 B_t = 1 - {}_0 R_t = (\mu_0 - \mu_t) / \mu_0$$

<sup>1</sup> The fixation of plastic elements, by means of which the growth and reconstitution of the cellules of the organism are ensured, or anabolism, and the production of heat and energy by the oxidation of dynamic elements, or katabolism, constitute together the metabolism of the organism. The rate of metabolism or of waste and repair may appropriately be said to measure the plasticity of the organism. The plastic and dynamic elements, for example, the albumins, fats, hydrocarbons, etc., require also the presence of mineral salts and vitamines, in order to properly fulfil their nutritive and dynamic functions. The modifiability of the organism may of course be affected by its environment as well as by age: but its potential modifiability-may be regarded as the measure of its plasticity.

<sup>&</sup>lt;sup>2</sup> The error of this assumption is, of course, nearly negligible for most purposes for almost any ages, and for the present purpose is quite negligible. The central death-rate is the number of deaths occurring between any age limits divided by the mean population.

That is, the table for the period 1881-1891 can be regarded as referable to the point of time 1886.0, and the table for 1901-1911 to the moment 1906.0.

with suffixes to denote the age to which the formula refers. As already indicated, the magnitude of B will be influenced by various circumstances. For example, the ratio of improvement will probably be low (and as a matter of fact is low) for those ages which are characterised by the lowest rates of mortality<sup>1</sup>; that is for the ages when vitality is greatest a favourable advance in the environment will produce a relatively small effect. To analyse the effect of the value of the death-rate upon the improvement we may divide B by the geometric mean of the death-rates measuring the change; that is by:—

$$(606)\ldots \mu_m = \sqrt{(\mu_0 \, \mu_t)},$$

and call the ratio of the betterment to this quantity,  $\lambda$ , or the *relative betterment*, <sup>2</sup> thus:—

$$(607).....\lambda_t = B_t / \mu_m \equiv (1 - \mu_t / \mu_0) / \sqrt{(\mu_0 \mu_t)}$$

Since the limits of B are 0 and 1, this quantity can attain to considerable magnitude when t is considerable, and is therefore a sensitive measure of any improvement in the rate of mortality.

The following Table gives for males and females the values of  $\mu_m$ , B, and  $\lambda$ , the values for  $\mu_0$  and  $\mu_t$  being those given by the analysis of the Census results for thirty years, and the interval being referable therefore to the period between 1886.0 and 1906.0. For values of R, if required, we have simply 1 - B.

The values of B are shewn in Fig. 100, curves B and B'; in which also the mean death-rates  $\sqrt{(\mu_0\mu_t)}$  are shewn, viz., curve A male, and curve A' female. These exhibit the following characteristics:—

Curves of Relative Improvement for 20 Years in Death-rates.

	Initial Point.	lst Maximum Age. Amount.	lst Minimum. Age. Amount.	2nd Maximum. Age. Amount.	Remarks.
Males Females	$0.175 \\ 0.215$	2.8 yrs. 0.508 2.7 yrs. 0.520	12.8 yrs. 0.209 13.2 yrs. 0.224	23.3 yrs. 0.491 24.5 yrs. 0.400?	Later values. are irregular

Upon plotting the ratio of the betterment, viz., the values of  $\lambda$  for males and females, we obtain the results as shewn upon Fig. 100 by curves C and C'', representing the ratio of improvement in the case of males, and curves C' and C''', representing the ratio of improvement in the case of females. These exhibit the following characteristics:—

Ratio of the Relative Improvement to the Death-rate for 20 Years.

		lst Maximum. Age. Amount.		2nd Maximum. Age. Amount.	Remarks.
Males	0.70	9.2 yrs. 164.6	13.8 yrs. 94.8	16.8 yrs. 109.4	Results after-
Females	1.07	9.5 yrs. 176.4	(13.8 yrs. 108.3)	(16.8 yrs. 100.5)	wards irregular

This corresponds with the age at which the reproductive function commences to unfold, viz., at about age 12. Probably what may be called the age of effloresence of the organism is generally its period of highest vitality.

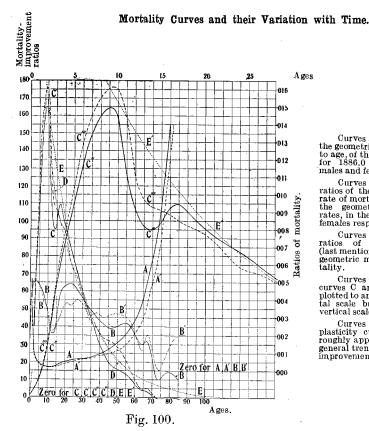
<sup>&</sup>lt;sup>2</sup> This is suggested by the word  $\beta \epsilon \lambda \tau l \omega \sigma \iota s$ , i.e., betterment;  $\beta$  is already appropriated for birth-rate, etc.

The values for age 0 cannot be deemed to closely represent the facts; to obtain these a table of deaths occurring on successive days after birth would be needed, and not merely extrapolated results based upon successive years. For all other ages, however, they represent the facts with considerable accuracy.

It will be convenient to call the ratio  $\lambda$  the mortality improvement ratio.

TABLE CXL.—Shewing the Mean Mortality, the Relative Improvement in Mortality in 20 Years and the Ratio of this Relative Improvement to the Mean Mortality for Males and Females. Australia, 1886.0 to 1906.0.

		MA	LES.		F	EMALES				MA	LES.		F	EMALES	
Exact	Moon	Improv	ement.		Mean	Improv	ement.	Exact	Mean	Improv	1		Mean	Improv	
Age.	Mean Death Rate 1896.0	Re- lative.	Ratio to Death Rate	Plas- ticity Curve	Death Rate		Ratio to	Age.	Death	Re- lative.	Ratio to Death Rate.	Plas- ticity Curve	Death Rate 1896.0	Re- lative.	Ratio to Death Rate.
0 1 2 3 4	25100 04640 01750 00796 00559	451 499 5 507	$9.7 \\ 28.5 \\ 63.7$	$\begin{array}{ c c c c }\hline 265.0 \\ 251.8 \\ 239.2 \\\hline \end{array}$	04270 01660 00752	$ \begin{array}{c c} 463 \\ 514 \\ 519 \end{array} $	31.0 69.0	46 47 48	$\begin{array}{c} 01217 \\ 01283 \\ 01353 \\ 01426 \\ 01503 \end{array}$	$\begin{array}{ccc} & 239 \\ & 239 \\ & 244 \end{array}$	$17.7 \\ 17.0$	$25.0 \\ 23.8$	01018	312 317 321	32.2 31.6 31.1 30.4 29.4
5 6 7 8 9	00441 00354 00299 00263	469 0 449 7 429	132.5 $150.1$ $158.4$	$\begin{array}{c c} 215.9 \\ 205.5 \\ 194.8 \\ 185.1 \end{array}$	00409 00324 00269 0023	470 432 5 395	145.0 $160.6$ $168.1$	51 52 53	01588 01668 01758 01858 01964	256 3 · 260 5 · 263	15.3 $14.8$ $14.2$	19.4 18.4	01190 01249 01319	$\begin{array}{ccc} 319 \\ 317 \\ 316 \end{array}$	26.8 25.4 23.9
10 11 12 13 14	0022 0020 0020 0021 0024	$egin{array}{c c} 8 & 264 \\ 6 & 219 \\ 6 & 210 \\ \hline \end{array}$	126.9 106.3 17.3	$egin{array}{ccc} 158.7 \ 150.7 \ 2 & 143.2 \end{array}$		$\begin{array}{cccc} 3 & 303 \\ 5 & 244 \\ 4 & 223 \end{array}$	$egin{smallmatrix} 158.0 \ 125.1 \ 110.5 \end{bmatrix}$	56 57 58	0208 02209 02349 02509 0266	$\begin{array}{ccc} 9 & 266 \\ 9 & 259 \\ 3 & 246 \end{array}$	12.0 11.0 10.6	$egin{array}{cccc} 15.8 \ 15.0 \ 14.2 \ \end{array}$	$0158 \\ 0169 \\ 0181$	$egin{array}{cccc} 6 & 295 \ 4 & 284 \ 4 & 267 \ \end{array}$	18.8 16.8 14.7
15 16 17 18 19	0028 0033 0038 0042 0046	$     \begin{array}{ccc}       5 & 359 \\       5 & 42 \\       9 & 459     \end{array} $	1 106.9 1 109.3 0 104.	9 122.8 3 116.6 9 110.8	3 0027 3 0030 3 0034	3 285 9 300 3 33	2 103.; 6 98.9 3 97.	62 1 63	0284 0303 0323 0346 0374	$egin{array}{ccc} 0 & 195 \ 4 & 175 \ \end{array}$	2 6.5 2 5.5 6 4.5	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c c} 0224 \\ 0241 \\ 0260 \end{array}$	$egin{array}{cccc} 9 & 186 \ 8 & 156 \ 5 & 12 \ \end{array}$	8.2 6.4 7 4.9
20 21 22 23 24	0049 0053 0055 0057 0059	1 48 6 48 7 49	3 91 7 87. 1 85.	9 95. 6 90. 1 85.	$0   0043 \ 0045 \ 7   0047$	$ \begin{array}{ccc} 1 & 38 \\ 7 & 37 \\ 9 & 37 \end{array} $	$egin{array}{ccc} 0 & 88.3 \ 9 & 82.5 \ 1 & 77. \end{array}$	2 66 9 67 5 68	0409 0452 0497 0542 0586	$\begin{array}{ccc} 0 & 16 \\ 1 & 16 \end{array}$	$egin{array}{cccc} 6 & 3.5 \ 7 & 3.5 \ 1 & 2.5 \end{array}$	7 9.4 4 9.0 5 8.1	$ \begin{array}{c cccc} 0 & 0351 \\ 0 & 0389 \\ 5 & 0425 \end{array} $	$egin{array}{cccc} 4 & 179 \ 8 & 20 \ 3 & 19 \ \end{array}$	5.1 1. 5.2 4 4.0
25 26 27 28 29	0061 0063 0064 0065	$\begin{array}{ccc} 30 & 47 \\ 42 & 45 \\ 51 & 44 \end{array}$	3 74. 8 71. 0 67.	9 73. 3 69. 6 66.	5 0056 8 0059 3 0061	5 39 93 40 9 39	6 70. 3 67. 8 64.	$     \begin{array}{c cc}                                   $	0628 0672 0724 0788 0864	$\begin{array}{c c} 10 &03 \\ 33 &05 \end{array}$	3 0 1 —	2 7.3 4 6.5 7 6.5	$   \begin{array}{c cccc}     & 0531 \\     & 0574 \\     & 0626 \\   \end{array} $	$ \begin{array}{c cccc}  & 05 \\  & 0 & -00 \\  & 0 & -04 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
30 31 32 33 34	0066 0068 0069 0073	$egin{array}{cccc} 30 & 39 \ 26 & 37 \ 14 & 36 \ \end{array}$	$\begin{array}{ccc}  & 57. \\  & 52. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & 50. \\  & $	.6 56. .6 54. .4 51.	9 0066 0 0067 3 0069	$egin{array}{cccccccccccccccccccccccccccccccccccc$	51 54. 18 50. 14 46.	4 76 0 77 8 78	0948 103 113 123 133	$ \begin{array}{c cccc} 35 &03 \\ 26 &02 \\ 22 &01 \end{array} $	2 — 21 — 2 —	3 5. 2 5. 1 5.	7 084 4 092 1 10	$ \begin{array}{c cccc} 43 &00 \\ 26 & +01 \\ 13 & 04 \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
35 36 37 38 39	0076 0075 0085 0086 0096	63 34 95 33 26 31 62 30	12 44 30 41 18 38 03 35	$\begin{bmatrix} .5 & 41 \\ .2 & 39 \end{bmatrix}$	1 0070 8 0079 7 008	$     \begin{array}{ccc}       62 & 31 \\       90 & 32 \\       16 & 32      \end{array} $	$egin{array}{cccc} 17 & 41 \ 21 & 40 \ 24 & 39 \ \end{array}$	$     \begin{array}{c c}       6 & 81 \\       6 & 82 \\       7 & 83      \end{array} $	145 153 164 177 19	30 —01 45 —01 75 —02	13 —. 18 —. 29 —.	$egin{array}{cccc} 1 & 4. \ 1 & 4. \ 2 & 4. \end{array}$	$egin{array}{c c} 4 & 135 \\ 2 & 144 \\ 0 & 156 \\ \end{array}$	$egin{array}{ccc} 40 & 12 \ 39 & 13 \end{array}$	4 . 1 . 4 .
$\begin{array}{c} 40 \\ 41 \\ 42 \\ 43 \\ 44 \end{array}$	009 010 010	$egin{array}{ccc} 37 & 26 \ 94 & 25 \ \end{array}$	31 29 74 27 36 25 58 23 50 21	.6 32 .6 30	.1 008 .4 008 .7 009	76 30 96 30 19 30	16 36 07 35 01 33 01 32 07 32	.0 86 .6 87 .7 88				3. 3. 3. 3. 2.	$\begin{bmatrix} 4 \\ 2 \\ 1 \end{bmatrix}$		



Curves A and A' represent the geometric means, according to age, of the rates of mortality for 1886.0 and 1906.0, for males and females respectively.

Curves B and B' are the ratios of the diminution in the rate of mortality in 20 years to the geometric mean of the rates, in the case of males and females respectively.

Curves C and C' are the ratios of the improvement (last mentioned) divided by the geometric mean rates of mortality.

Curves C" and C" are the curves C and C' respectively, plotted to an extended horizontal scale but with the same vertical scale.

Curves E and E'—the plasticity curve—shews, in a roughly approximate way, the general trend of the mortality-improvement ratio: see § 10.

9. Significance of the variations in the mortality improvement ratio.—The following relation between the changes in mortality and in the mortality-improvement-ratio is important.

The variations of the curve of the mortality improvement ratio are reciprocal to those of the mortality itself; that is, x and  $\eta$  being the ordinates to the mortality-improvement-ratio curve, and x and y the ordinates to the mortality curve, we have, practically for all ages, 1:—

$$(608)....\eta'/\eta = Ky/y'; \text{ or } s = K/r$$

 $\eta$ ,  $\eta'$  and y, y' being successive ordinates, and s and r their respective ratios.<sup>2</sup> K, however, is not a constant; nor is it any simply expressed function of x, though generally it is a little less or a little greater than unity.

<sup>&</sup>lt;sup>1</sup> Certainly for all ages for which the mortality ratio can be very accurately evaluated.

<sup>&</sup>lt;sup>2</sup> That is  $\eta$  and y are values for x, and  $\eta'$  and y' values for x + 1.

This reciprocal relationship reveals the fact that as the mortality at the beginning of life decreases with the successive years, the relative-improvement-ratio increases in very similar proportion. This reciprocal movement of the mortality-ratio, as compared with the mortality-improvement-ratio with increasing age, probably continues throughout life, and certainly continues till at least age 70. The values of the coefficient K in (608) above, are given in Table CXLI.,  $K_m$  denoting those which apply to males and  $K_f$  those which apply to females. The ratios  $s=\eta'/\eta$  and 1/r=y/y' are also shewn, viz., by the smaller figures between the values of  $\eta$  and y respectively. This coefficient K may be called the beltiotic coefficient.

TABLE CXLI.—Shewing the ratios between the mean mortalities and the mortality-improvement-ratios for successive ages. Australia, 1886-0 to 1906-0.

	Ratio	Ratio of Mor-	Values		Exact	Ratio	Ratio of Mor- tality		of K	Exact Ages	of	Ratio of Mor- tality	Values	of K
+0	of Mean Mortalities $(1/r)$	ment	Males. $K_m$	Fe-	$\begin{array}{c} \text{Ages} \\ \text{from} \\ \text{to} \\ (x). \end{array}$	Mean Mor- talities	Im- prove-	Males. $K_m$	Fe- males. $K_f$	from to	Mean Mor- talities	Im- prove-	Males. K,n	Fe- males. $K_f$
0-1 1-2 2-3 3-4 4-5 5-6 6-7 7-8 8-9 9-1 10-1 11-1 13-1 14-1 15-1 16-1 17-1 18-1 19-2 20-2 21-2 22-2	2.651 2.198 1.424 1.268 1.124 1.120 1.099 1.095 1.067	2.232 1.401 1.237 1.197 1.133 1.055 1.055 1.024 914 914 914 915 1.045 917 917 918 919 919 919 919 919 919 919 919 919	1.107 1.016 .984 .976 .961 .957 .942 .914 .935 .731 .830 .958 1.090 1.231 1.270 1.173 1.025 1.025 1.025 1.025 3.942	1.110 1.011 .970 .978 .956 .919 .914 .955 .862 .800 .926 1.054 1.079 1.085 1.085 1.085 1.085 1.085 1.085 1.019	30-31 31-32 32-33 33-34 34-35 35-36 36-37 37-38 38-39 40-41 41-42 42-43 43-44 44-40 45-46 46-47 47-48	.988 .982 .975 .975 .963 .964 .958 .958 .958 .958 .948 .948 .948 .949 .949 .949 .949 .94	968 936 913 958 949 936 927 913 911 920 932 924 924 928 938 949 958 978 978 979 979 979 979 979 97	.980 .953 .934 .983 .978 .970 .965 .953 .973 .971 .971 .971 .968 .978 .1.000 1.014	.936 .959 .972 .997 1.009 1.002 1.009 .997 .978 .981 1.009 1.006 1.015 1.013 1.003	63-64 64-65 65-66 66-67 67-68 68-69 70-71 71-72 73-74 74-75 75-76 77-78	.939 .938 .938 .937 .937 .925 .912 .907 .913 .917 .912 .912 .912 .912 .912 .912 .912 .912	809 869 850 837 849 950 970 929 824 554 554 565 967 970 970 970 970 970 970 970 97	.862 .927 .906 .893 .910 .954 1.039 1.069 1.069 1.584 .427	.837 .821 .904 1.202 1.293 1.126 .960
23-2 24-2 25-2 26-2 <b>27-</b> 2	5 .97 6 .97 7 .98	5 .968 1 .961 8 .953 1 .953	3 .998 1 .990 2 .978 1 .969	$ \begin{array}{c c} 1.030 \\ 1.034 \\ 1.017 \end{array} $	52-53 53-54 54-55	948 1 .948 5 .944	$egin{array}{lll} 959 \\ 5 & .958 \\ 1 & .946 \end{array}$	1.011 1,014 1.002	.997 $.982$ $.982$	80-81 81-82 82-83	.929 2 .930 3 .927	$egin{array}{ccc} .916 & .917 \ .918 & .918 \ \end{array}$		

The ratios in the Table (1/r) are the values of the mortality at any age divided by the mortality at the age greater by one year; that is, the tabular values are the quantities  $\mu_x/\mu_{x+1}$ .

The tabular ratios of the mortality-improvement-ratios are the values obtained by dividing the mortality-improvement-ratio for any age by that of the age less by one year; that is the tabular values are the quantities  $\lambda_{x+}/\lambda_x$ 

The coefficient K is that quantity which multiplied into the ratio of the mean mortalities, gives reciprocally the ratio of the mortality-improvement-ratios.

<sup>3</sup> From βελτιωτικόs, bettering or amending.

If the value of the ratio y is required for a single unit of time (1 year), we have, on the assumption of a geometrically progressive decrease in mortality,  $\mu_1 = \mu_t^{\frac{1}{t}}$ ; consequently:—

$$(609)...B_{1} = [1 - (\mu_{t}/\mu_{0})^{\frac{1}{t}}]/\mu_{0} \text{ and } \lambda_{1} = (1 - \mu_{1}/\mu_{0})/\sqrt{(\mu_{0} \mu_{1})}$$

$$= B_{1}/(\mu_{0}^{2t-1}\mu_{t})^{\frac{1}{2t}}$$

$$(610)......\xi^{t} = \mu_{t}/\mu_{0}; \text{ and } \mu_{1} = \mu_{0}\xi$$

The form of the expression for  $\lambda$  is independent of the unit of time, though of course its numerical value is dependent on that unit.

10. The plasticity curve.—If we except the period between exact ages 14 and 17, the beltiotic coefficient continually decreases in value from age 10. If a curve be drawn representing the general result, it is found (from the 20 years' improvement in the mortality conditions) that it is fairly well represented by the equation  $y = 278.95 (0.95)^x$ . This curve, viz., E and E' on Fig. 100, may be called the plasticity curve, and its ordinates are given in Table CXL. The amount by which the beltiotic curve (i.e., the curve of the mortality-improvement-ratio) falls short of the plasticity curve, does not, however, and least of all initially, constitute a measure of the great difficulty of attaining to the limit, which plasticity would admit of, were it not for the great difficulty of initial adjustment to a new environment, and to the exhaustion of energy involved by puberal developments. For the analysis of these questions, however, the available data appear to be inadequate, and they will not be further discussed here.

No simple relation expresses the variation of the constants 278.95 and 0.95 with the unit of time over which the improvement is measured.

11. Rate of mortality at the beginning of life.—The mortality at the beginning of life is probably considerably affected by local circumstances; consequently for the first two weeks and perhaps even the first month of life it would be difficult to assign any particular law of change of mortality with age. Statistics for Saxony gave a first minimum rate at 8 days, and a lesser maximum 15 days, and those for Sweden gave

<sup>&</sup>lt;sup>1</sup> It may be noted that for the relative improvement to be unity we must have  $\mu_t = 0$  in (605), that is to say, death must vanish. But no diminution of mortality in a geometrical ratio can reach zero, for though  $\mu_0 \, \xi^t$  may be as small as we please, it cannot become zero with  $\, \xi \,$  positive and  $\, t \,$  finite: moreover, when the death-rate is large the value of λ cannot be great with any practicable change of death-rate.

<sup>&</sup>lt;sup>2</sup> See "The improvement in infantile mortality: its annual fluctuations and frequency according to age in Australia." by G. H. Knibbs, Journ. Australas. Med. Congress., Sept. 1911, pp. 670-679; see also "Die Sterblichkeit im ersten Lebensmonat, Zeit. f. Soz. Mediz., Leipzig Bd. v., p. 175, 15th April, 1910.

a somewhat similar indication <sup>1</sup>, while Australian records do not lend any support to this recrudescence of the rate of mortality. Prussian statistics shew a minimum rate for 9 days and a rise to 14 days. <sup>2</sup>

The statistics in Australia are imperfect, and some distributing was necessary owing to the want of precision in stating the exact interval after birth. The defective statement of age does not, however, affect the deductions hereinafter. In the following table the results for the fractions of the first day are merely computed: the rates, calculated without regard to migration, the effects of which are nearly negligible, and are not accurately ascertainable, are determined by deducting the deaths from the total births in order to ascertain the numbers of survivors.

The rates so found shew that from the end of the first day the law of mortality is expressed by  $\mu_x = \mu_1/x$ , for 5 or even 6 days. The generality of this expression can be extended, if it be put in the following form, viz.:—

(611)...
$$\mu_x = \mu_{\scriptscriptstyle 1} \left[ 1 + f\left( x \right) \right] \! / \! x,$$
 consequently  $1 + f\left( x \right) = x \; \mu_x / \mu_{\scriptscriptstyle 1}$ 

and f(x) for the first 5 or 6 days is zero. The shorter expression indicates that after the first 24 hours, and for about the first week of life the probability of death diminishes as the length of time lived, reckoned from the moment of birth. The following rates are computed for "persons" (i.e., males and females) from the records of about 500,000 births and the deaths which resulted from them.

TABLE CXLII.—Death-rates per diem at the Beginning of Life. Based upon 499,674 Births, and the Deaths occurring therein. Australia, 1909, 1910, 1912 and 1913.

Age- group or Age Days.	Death- rates per Diem.	Age Days.	Death- rates per Diem.	Age Days.	Death- rates per Diem.	Age Days.	Death- rates per Diem.
0* 0-8* 18-14* 14-2* 12-2* 23-1* 0-1* 12-3-4 13-14* 14-2-14* 23-4-14* 14-2-14* 24-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-14* 14-4-	$\begin{array}{c} .015000 \\ .014061 \\ .012355 \\ .010143 \\ .007934 \\ .006330 \\ .009404 \\ .005743 \\ .002927 \\ .001899 \\ .001416 \end{array}$	4 5 6 7 8 9 10 15 20 30 40	$\begin{array}{c} .001416 \\ .001137 \\ .000975 \\ .000853 \\ .000767 \\ .000703 \\ .000653 \\ .000497 \\ .0003961 \\ .0002678 \\ .0002237 \end{array}$	40 50 60 70 80 90 100 125 150 175 200	$\begin{array}{c} .0002237 \\ .0002117 \\ .0002035 \\ .0001948 \\ .0001875 \\ .0001804 \\ .0001740 \\ .0001594 \\ .0001337 \\ .0001233 \end{array}$	200 225 250 275 300 325 350 365 	.0001233 .0001142 .0001063 .0000986 .0000923 .0000865 .0000821 .00001084

<sup>\*</sup> Approximate estimates only. There are no available statistics for the accurate estimation of the frequency of death during each of the first 24 hours of life.

<sup>&</sup>lt;sup>1</sup> Op. cit., p. 676. The results are given on graph No. 7 on the page mentioned.

<sup>&</sup>lt;sup>2</sup> See Handbuch d. Med. Statistik., Fr. Prinzing, 1906, pp. 281-2; also G. Lommatzsch. Zeit. f. sächs. stat. Bureau, 1897, Bd. xliii., p. 1.

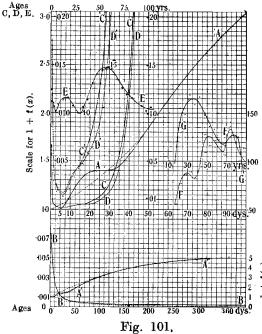
We may take the mean of  $\mu/x$  for the first 5 days as the value of the mortality at the end of the first day; this gives the rate 0.005729 per diem. Using this to determine 1+f(x), we find that its values are as follow:—

TABLE CXLIII.—Shewing the Values of  $x\mu_x/\mu_1$ , that is 1+f(x) in (611).

Exact	1 +	f(x)	Exact	1 +	f(x).	Exact	1 +	-f(x).
Age, Days.	Crude.	Smooth- ed.	Age, Days.	Crude.	Smooth- ed.	Age, Days.	Crude.	Smooth ed.
1–5	1.0000	1.0000	30	1.4023	1,4023	125	3.4779	3.4373
6	1.0211	1.0200	35	1.4442	1.4442	150	3.8331	3.8067
7	1.0422	1.0438	40	1.5619	1.5620	175	4.0841	4.1022
8	1.0710	1.0714	45	1.7038	1.7043	200	4.3044	4.3342
9	1.1044	1.1028	50	1.8476	1.8466	$\frac{1}{225}$	4.4851	4.5131
10	1.1398	1.1380	55	1.9894	1.9889	250	4.6387	4.6493
12.5	1.2280	1.2280	60	2.1313	2.1312	275	4.7329	4.7532
15	1.3013	1.3013	70	2.3802	2.3930	300	4.8333	4.8352
17.5	1.3526	1.3526	80	2.6182	2.6330	325	4.9071	4.9057
20	1.3828	1.3828	90	2.8340	2.8500	350	5.0157	4.9749
25	1.3990	1.3990	100	3.0372	3.0450	365	5.1096	1.0.10
30	1.4023	1.4023	125	3.4779	3.4373			• •

From 5 to 10 is a second degree curve, the 1st diff. for a unit being = + 0200, 2nd diff. = + 0038. From 40 to 60 is a straight line, the common difference for a unit being + 02846. The curve from 60 to 120 is a second degree curve, the 1st diff. being + 0.2622 and the 2nd diff. - 0.02288. From 125 to 350 is a third degree curve, the first rank of difference being + 0.3694, - 0.0739, and + 0.0104, the last being the common differences.

The results in the above table shew that although for the first few (five) days the death-rate diminishes as the duration of life, this rapid rate of diminution is not continued, but the rate falls off more slowly—and on the whole continually—till the minimum death-rate occurs.



## Mortality Curves.

Curve A A shews the values of 1 + f(x) for 90 days, see (611) p. 390. Curve A' A', shews on a smaller scale the values of 1 + f(x) for 360 days.

Curve B B is the curve of rates of mortality for 360 days; the dotted line shews what would be the curve if the hyperbolic law held throughout.

Curve C C is the curve of rates of mortality for males, and curve D D is that for females.

Curves C' and D' are the same as C and D, except that the vertical scale is increased tenfold.

Curve E E is the curve of masculinity of the rates of mortality according to age; see Table CXLVI.

Curve FF is the curve of the ratios of the rates of mortality for males "not married" to those for married males, according to age.

Curve G G is the curve of the ratios of the rates of mortality for females "not married" to those for married females, according to age.

The characteristics of the diminution of the initial death-rate may be summed up as follows :--

- (a) For the first 24 hours of life satisfactory data do not exist to determine the characteristics of the death-rate (see below).
- (b) From the end of the first to the end of the fifth day the rate varies inversely as the duration of life.
- (c) From the end of the fifth day the rate of diminution rapidly falls off till about the 20th day, then less rapidly till the 30th day, then the rapidity of the falling off of the rate of diminution approximates to what it was from the 5th to the 20th days, but after that decreases slowly and fairly regularly.
- (d) No simple function expresses these changes in the variation of the death-rate, and they probably differ somewhat in different countries.

If the expression (611) is put into the form :—

$$(612).....\mu_x = \frac{\mu_1}{x} e^{a (x-1)^b}$$

this can be fitted to a considerable range of the curve, provided that minor fluctuations are ignored. It cannot, however, represent with sufficient accuracy a year's results. To fit any two points on the curve besides the origin we have :-

(613) ..... 
$$\log \frac{\log y'}{\log y} = b \log \frac{x'-1}{x-1}$$

(613) ...... $\log \frac{\log y'}{\log y} = b \log \frac{x'-1}{x-1}$  in which  $y=x\mu/\mu$ , =1+f(x). When b is found a can be readily obtained from (612).

For the values of  $\mu$  for fractions of the first day it may be assumed that the curve is  $\mu_0 e^{-x}$ . For this to give .995729 at the end of the first day we must make  $\mu_0 = 0.015573$  (per diem), and this would be the mortality for x=0, viz., at the moment of birth, and is equivalent to a death-rate of 5.684 per annum. This may be put in another way, viz., it is equivalent to a rate of unity per 64.21 days (i.e.,  $365 \div 5.684$ ), and implies that such a rate, if operating uniformly for that period on a group of children for 64.21 days, the group being kept constant, would in that time account for the death of all born.

Composite character of aggregate mortality according to age.— Before dealing further with the variation with age of the rate of mortality, it is desirable to review the nature of the aggregate rate of mortality.

The general rate of mortality for any age,  $D_x/P_x = \mu_x$ , viz., the aggregate number of deaths of persons between given infinitesimal limits of age occurring in a unit of time, divided by the average number of persons of the same age 1 (the average being taken over the unit period in which the

<sup>&</sup>lt;sup>1</sup> In practice D and P are taken between limits x and x', say, in which case  $\mu$ is not given but instead the average over the range. The difference is dealt with later.

deaths occurred) is made up of the rates from each cause, and if regarded from the summation point of view --see (596), p. 370-is compounded of a series of rates, the graphs of which are by no means similar. For example, in "causes of deaths," Nos. 31 and 32, the real number at risk are those shewn in line 2 below, the variation with age is quite unlike the variation with age of the total mortality, and is by no means identical in the two cases, as will be at once seen from a Table given hereinafter. The results are as follows:-

			,							
1. Age-group 2. Cases of Maternity	10–14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	Ttl.
1907-1915* 3. Cases of Puerperal	211	54,527	262,866	317,815	238,746	155,813	60,970	6,075	79	
Septicæmia 4. Ratio	$^{1}_{.00474}$	96 .00176	370 .00141	515 -00162	459 .00192	307 .00197	$\frac{112}{.00184}$	12 00197	1 ? .01266 ?	1872
5 Cases of other Ac- cidents of Preg-		100110	.00111	.00102	.00152	100101	.00101	.00131	.01200 1	٠.
nancy & Labour 6. Ratio		161 .00295	587 .00223	816 .00257	799 .00335	$829 \\ .00532$	397 $.00651$	55 00905	.00000 ?	3648
				.0020.			.00001	.00000		• •

<sup>\*</sup> Actually births. These are, however, only slightly too great. The correction may be neglected for the present purpose.

The results shew that out of a total of 100 deaths at all ages from puerperal septicæmia and other accidents of pregnancy and labour, 34 will arise from the former cause, and 66 from the latter; and also that the distribution according to age differs considerably for septicæmia; the proportion dying at different ages remaining more nearly constant than in the case of deaths from other accidents of pregnancy and labour. The fall to a minimum occurs at about age 23.4, when the ratio is about 0.00219. The minimum in the case of septicæmia is at about age 23.1, and the ratio is about 0.00139, the proportion of the deaths from other accidents of pregnancy, etc., being here 0.61 of the two combined.1

Causes of death may be classified, as regards their relative frequency according to age, as follow, viz.2:-

> (i.) Normal, viz., those in which the relative frequency is similar to the relative frequency of death from all causes combined;

<sup>&</sup>lt;sup>1</sup> See formulæ (292) and (294), p. 92 herein.

<sup>&</sup>lt;sup>2</sup> The causes of death given in a Table hereinafter may be classified according to the scheme indicated, and are as follows, viz. :

to the scheme indicated, and are as follows, viz.:—

Class (1.) Normal.—9. Influenza; 12. Epidemic Diseases; 16a. General Diseases; 18. Cerebral Hæmorrhage, etc.; 18a. Other Diseases of the Nervous System; 20. Acute Bronchitis; 22. Pneumonia; 23. Other Diseases of the Respiratory System; 24. Diseases of the Stomach; 25. Diarrhea and Enteritis; 27. Hernia and Intestinal Obstruction; 28a. Diseases of the Digestive System; 32a. Diseases of the Stin and Cellular Tissue; 32b. Diseases of the Organs of Locomotion; 35. Violent Death; 38. Ill-defined Diseases.

Class (ii.).—Infantile, Sub-classes (a), (b) and (c).—5. Measles (b); 7. Whooping Cough (a); 8. Diphtheria and Croup (b); 14. Tubercular Meningitis (b); 15. Other Forms of Tuberculosis (c); 17. Simple Meningitis (a); 33. Congenital Deblity and Malformations (a); 33a. Other Diseases of Infancy (a).

Class (iii.).—Semile.—16. Cancer and other Malignant Tumours; 19. Organic Diseases of the Heart; 19a. Other Diseases of the Circulatory System; 21. Chronic Bronchitis; 28. Cirrhosis of the Liver; 34. Senile Debility.

Class (iv.).—Median.—1. Typhoid Fever; 13. Tuberculosis; 26. Appendicitis, etc.; 31. Puerperal Septicemia; 32. Accidents of Pregnancy and Labour; 36. Median; 30. Non-cancerous tumours of the female genital organs.

Organic diseases of the heart and other diseases of the circulatory system are

Organic diseases of the heart and other diseases of the circulatory system are hardly to be included in the "normal" series, because the death-rate in the first year of life is not very great.

- (ii.) Infantile, viz., those which characterise infancy only;
- (iii.) Senile, viz., those which characterise old age only;
- (iv.) Median, viz., those which characterise middle age only.

The infantile causes of death may be subdivided into three subclasses, viz. (a) those in which the mortality is greatest in the first year of life; (b) those in which it is later than the first year; and (c) those in which the mortality is greatest in the first year, but is followed by an irregular mortality for all ages.

It is obvious that, apart from variations in the distribution according to age, and general differences in local salubrity, epidemics will cause differences in mortality rates according to age, hence to be representative of a country, the deduced mortality rates must be taken over a sufficient period of time. The results in the Table CXLIV. hereinafter are based upon 9 years' experience, viz., from 1907-1915 in Australia, and the distribution of the population, according to age and sex is assumed to be as at the Census of 3rd April, 1911. Before analysing these results it will be necessary to consider the character of curves of organic increase or decrease.

13. The curve of organic increase or decrease.—The curve  $e^x$  (or  $e^{-x}$ ) and its variants, may, for obvious reasons, appropriately be called the curve of organic increase or (organic decrease). In considering its application to the increase of population by birth or the reduction of population by death, etc., certain characters of the curve deserve notice, and will now be considered. If to adapt it to a given instance, the expression be put in the more general form hereunder, we may note that:—

$$(614)....y = Ae^{nx+a} = (Ae^a)e^{nx} = A'e^{nx} = A'm^x$$

in which  $m = e^n$ . Hence the addition of a constant to the index of e affects only the vertical scale of the graph of the curve, while n affects its horizontal scale. If n be constant the final form in the above expression is satisfactory, but if it change with x, then the appropriate expression is—

$$(615)....y = Ae^{nx\phi(x)} = Ae^{x.n\phi(x)} = Ae^{n'x} = A\phi(x)^x$$

and the form of  $\phi(x)$  will be determined by the law of change in n'. Geometrically this is equivalent to changing the x-scale as x increases.

In order to ascertain the form of  $\phi(x)$  the quantities, group or other, may be set out as shewn hereunder, and the quotients B/A = b, C/B=c, etc., computed. If b, c, d, etc., are not equal, then the curve  $Be^{bx}$  will not satisfy the data. If on computing also the values of b (c-1)/(b-1); c(d-1)/(c-1), etc., it is found that they are not equal, the curve  $A+Be^{bx}$  will also not satisfy the values. The last step may be shortened by putting the above in the form (c-1)/(1-1/b). Similarly, if the quotients of the differences of the ordinates are not equal the equation will not apply.

## Scheme of Examination of Data.

Value, of ... 
$$x_1$$
 ...  $x_2$  ...  $x_3$  ...  $x_4$  ...  $x_4$  ...  $x_5$  ... etc. or Range between  $x_1$  to  $x_2$  ...  $x_2$  to  $x_3$  ...  $x_3$  to  $x_4$  ...  $x_4$  to  $x_5$  ...  $x_5$  to  $x_6$  ... etc. Group value ... A , B , C , D , E , etc. Ratio B/A, etc. b c d e f Reciprocals A/B, etc. 1/b 1/c 1/d 1/e 1/f or Ratio of differences  $\frac{y_3 - y_2}{y_2 - y_1}$ ;  $\frac{y_4 - y_3}{y_3 - y_2}$ ; etc.

If the values are increasing in the order A... E, n is positive, if diminishing n is negative, x being regarded as positive throughout.

There is, of course, no universal guide for deciding what form of function to adopt, but if b, c, d ascend by a common difference, the function will be of the form  $Be^{bx(1+ax)}$ ; if by a common multiple, it will be of the form  $Be^{bx^s}$ ; if by a common power of x, of the form  $Be^{bx^s}$ , and so on. Successive values of  $m=e^n$  may therefore be analysed on the same principles as the original data.

14. Exact value of abscissa corresponding to the quotient of two groups.—It is obvious that if there be two distributions (e.g., the number of deaths occurring in a population of a given magnitude in a given unit of time, both set forth according to age) and the average over a range of the variable be ascertained (e.g., the average death-rate of all persons between ages  $x_1$  and  $x_2$ ) the quotient found, by dividing one group by the other group, with the same range, will, in general, be the exact value for some given value of the abscissa; and ordinarily this value must not be referred to the middle of the range in question, when high precision is desired. Let the two distributions be denoted by G and H, and let G be the numerator group and H the denominator group; and let the five quantities  $x_1, x_q, x_h, x_m$  and  $x_2$  denote respectively:—(i.) the value of the abscissa at the beginning of the group; (ii.) the abscissa of the mean ordinate of the group G, and (iii.) that of H; (iv.) the abscissa where the ratio becomes exact; and (v.) the value of the abscissa at the end of the range. That is, if  $_{a}y_{m}$  and  $_{h}y_{m}$  denote the ordinates at  $x_{m}$  for the two distributions, then we must have :-

$$(616)....G/H = {}_{g}y_{m}/y_{m}$$

The following laws hold as to the position of  $x_m$  in relation to  $x_g$  and  $x_h$  the latter being the abscissæ of the ordinates equal to the respective means of the two distributions;—

- (i.) The two distributions increase linearly, then  $x_m = \frac{1}{2}(x_1 + x_2)$ .
- (ii.) The relative increase of the two distributions, though not linear, is identical throughout (i.e., they increase in the same proportion); then  $x_m$  is the common abscissa of the means of the group-ordinates.

<sup>1</sup> Provided, however, that the prolongation of the bounding lines does not meet on the axis of the abscissæ, since, in this case, the required ratio holds for any value of x; that is to say, in this case  $x_m$  is indeterminate. This, however, does not vitiate the adoption of the middle of the range, or indicate that it should not be adopted.

- (iii.) The ordinates of one distribution are constant throughout; the values of the other are variable;  $x_m$  is the abscissa of the ordinate equal to the mean of the ordinates of the variable distribution.
- (iv.) The relative increase of the ordinates of distribution G is more rapid than that of the ordinates of distribution H; then  $x_g > x_m > x_h$ .
- (v.) The relative increase of the ordinates of distribution G is less rapid than those of distribution H; then  $x_g < x_m < x_h$ .
- (vii.) Where the distributions G or H include maxima or minima (either one or both), no general law applies as regards the value of the abscissa  $x_m$ , and it may have more than one value. In general also the position of  $x_m$  in such cases is not accurately determinable from the group-data.

The most general supposition that can be made regarding the curve of instantaneous values which, between given limits, will satisfy a particular group-value (not near a maximum or minimum, at a point of inflexion, or very near the terminals) is that it is approximately represented by  $Be^{bx}$  or  $Bn^x$  in which  $e^b$  or n is the ratio of any group to the adjoining group. A curve of this type will satisfy three groups  $G_{-1}$ , G and  $G_1$ , in ascending or descending order of magnitude, see Part XIII., §25 (508), p. 266. Let the value of  $G/G_{-1}$  be  $n_1$ , and of  $G_1/G$  be  $n_2$ , then the value of  $m_1 = e^b$ , which will give a curve satisfying the three group totals, is  $a_1 = e^b$ .

$$(617)...$$
  $m = n_1 (n_2 - 1)/(n_1 - 1)$ 

The common quantity  $\chi$  to subtract so as to get three groups with the common ratio in between the second and first, and third and second, is :—

$$(618)....\chi = G(n_2 - n_1)/(1 + n_1 n_2 - 2n_1)$$

where G is the central group, and the position of the ordinate corresponding to the group-height, G / (x' - x) say, is wholly dependent upon  $\mathfrak{m}$ , which should be substituted for either  $n_1$  or  $n_2$ .

The abscissa of intercept of the group-rectangle with the curve of distribution is obviously independent of the scale, or of the zero of the

 $<sup>^1</sup>$  It is important to bear in mind when high accuracy is desired, that the mean of  $n_1$  and  $n_2$  is not necessarily at all near the value m. For example suppose the groups are 1000, 1200, and 2040, the value of  $n_1$  is 1.2, and of  $n_2$ , 1.7. The arithmetic mean is 1.45, and geometric 1.42829. While the value of m is 4.2. For the ratios (1000-937.5):(1200-937.5):(2040-937.5) are identical, and are 4.2. Similarly the groups 2040, 1200, and 1000 give for  $n_1$  the value 1/1.7=0.0588235, and for that of  $n_2$  the value 1/1.2=0.083333 give 1/4.2=0.0238095, as may be seen by applying the formula for the value of m. The position of the abscissa of the ordinate to the curve corresponding to the mean height is the same in either case, as also is the position of the centroid vertical.

 $<sup>^2</sup>$  The value of  $x_m$  is that of the abscissa of the point (or points), where a line parallel to the axis of abscissæ and distant therefrom the average of the group-ordinates cuts the bounding curve (the curve of distribution); or—in a graph—the abscissa of the intersection of the group rectangle with the curve of distribution.

figure. We suppose the range to be 0 to 1, and the curve to be  $y=Ae^{ax}$ , in which  $e^a$  is m. Hence since log.  $\mathfrak{m}=a$  log. e, we have by integrating between the limits 0 and 1:—

$$(619)....y_m = e^{ax_m} = \frac{1}{a} (e^a - 1) = \mathfrak{m}^{x_m} = \frac{\log e}{\log m} (m - 1)$$

Consequently by taking logarithms of this last form of the equation, we have, since  $\log_{10}~2.3025851 = 0.3622157$ :—

$$(620).....x_m = \frac{\log_{10}(\mathfrak{m}-1) - \log_{10}(\log_{10}\mathfrak{m}) - 0.3622157}{\log_{10}\mathfrak{m}}$$

To find the value of  $x_m$  when there are two curves we have, writing  $\xi$  for  $x_m$  for convenience, and in order to distinguish this case from the previous one:—

$$(621)\dots \frac{A(e^a-1)/a}{B(e^b-1)/b} = \frac{Ae^a\xi}{Be^b\xi}; \text{ wherefore } \frac{(\mathfrak{m}_a-1)/a}{(\mathfrak{m}_b-1)/b} = \frac{\mathfrak{m}_a^{\xi}}{\mathfrak{m}_b^{\xi}}$$

But 1/a divided by  $1/b = \log m_b/\log m_a$  consequently:—

$$(622).\dots.\left(\frac{\mathrm{im}_a}{\mathrm{im}_b}\right)^\xi = \frac{\log \mathrm{im}_b}{\log \mathrm{im}_a} \cdot \frac{\mathrm{im}_a - 1}{\mathrm{im}_b - 1} \,, \text{ and therefore}$$

$$(623)...\xi = \frac{(\log \mathfrak{m}_a - 1) - \log (\mathfrak{m}_b - 1) + \log(\log_e \mathfrak{m}_b) - \log(\log_e \mathfrak{m}_a)}{\log \mathfrak{m}_a - \log \mathfrak{m}_b}$$

which put in suitable form for computation with Briggsian logarithms is

$$(623a).....\xi = \log_{1}(m-1) = \log_{1}(m-1) + \log_{2}(m-1)$$

$$\frac{\log_{10}(\mathfrak{m}_{a}-1)-\log_{10}(\mathfrak{m}_{b}-1)+\log_{10}\,\log_{10}\,\mathfrak{m}_{b}-\log_{10}\,\log_{10}\mathfrak{m}_{a}-0.3622157}{\log_{10}\,\mathfrak{m}_{a}-\log_{10}\,\mathfrak{m}_{b}}$$

The fraction  $\xi$  can thus be readily tabulated in a table of double entry, with the arguments  $\mathfrak{m}_a$  and  $\mathfrak{m}_b$ . If in these last formulæ (623) or (623a) we put  $\mathfrak{m}_b=1$ , we get (620). If (623) is used it is important to note that the Napierian logarithms are to be used where indicated. Formula (622) may be regarded as the fundamental equation for the determination of  $x_m$  or  $\xi$ .

The preceding formulæ are unsuitable when  $\mathfrak{m}_a=\mathfrak{m}_b$ . But by putting  $\mathfrak{m}_a=\mathfrak{m}_b+h$  where h is a very small quantity, we obtain, after expanding both sides of the following equation, viz.:—

$$(624).....\left(\frac{\mathfrak{m}+h}{\mathfrak{m}}\right)^{\xi} = \frac{\log \ \mathfrak{m}}{\log \ (\mathfrak{m}+h)} \cdot \frac{\mathfrak{m}-1+h}{\mathfrak{m}-1}$$

which is (621) recast, and remembering that the powers of h are negligible :—

$$(625).....\xi' = \frac{\mathfrak{m}}{\mathfrak{m}-1} - \frac{1}{\log_{e} \mathfrak{m}}$$

 $\xi'$ , therefore, is not really indeterminate, when  $\mathfrak{m}_a=\mathfrak{m}_b$ , as might have easily been wrongly inferred from (623). When both  $\mathfrak{m}_a$  and  $\mathfrak{m}_b$  are 1 it may readily be shewn that  $\xi'=0.5$  by expansions applied to (625), which is but a special case of the following, viz.:—

If  $\mathfrak{m}_a = 1/\mathfrak{m}_b$ , then we have at once from (622) that  $\xi = \frac{1}{2}$ . And finally if  $m_a = k m_b$  we have

$$(626).....k^{\xi} = \{(k\mathfrak{m}_b - 1) \log \mathfrak{m}_b\} / \{(k-1) \log k\mathfrak{m}_b\}$$

by means of which also tables may be constructed.

The following table will enable the value to which any group-ratio should be referred to be readily found, after the values of  $\mathfrak{m}_a$  and  $\mathfrak{m}_b$  for the two distributions have been ascertained. Where the original distributions are increasing with x the value  $\xi$  given in the table is read from the left-hand toward the right; where diminishing, with increase of x, from the right-hand toward the left. Thus if  $\mathfrak{M}_a = 1/\mathfrak{m}_a$  and  $\mathfrak{M}_b = 1/\mathfrak{m}_b$ , then :—

$$(627)....\xi_{\mathfrak{M}}=1-\xi_{\mathfrak{m}}$$

consequently the table may be entered for the  $\mbox{ reciprocals of } both \mbox{\ensuremath{^{1}}}$  the ratios without altering the result provided the point to be determined is taken either  $\boldsymbol{\xi}_m$  from one end of the range or  $\boldsymbol{\xi}_{\mathfrak{M}}$  from the other.

TABLE CXLIV.—Shawing the values of  $\xi$ , viz., the relative Distance from the Initial Value of any Range on the Axis of abscissæ, to the Ordinate, to which the Ratio of any Two Groups should be ascribed, the whole Range being regarded as Unity.

VALUES OF  $\xi$ .

		ОП																			ma
та ОГ тъ	.05	.10	.15	.20	.25	.5	1.0	1.25	1.50	1.75	2.0	3	4	5	7.5	10	15	20	25	40	or mo
.05	281	.302	.315	.324	.332	.357	.383	.392	.399	.406	.411	427	.439	.447	.462	.474	.488	.500	.508	.525	.05
.10		.323	.337	.347	.355	.382	.408	.417	.424	.430	430	.49Z	.404	489	504	516	.530	.542	.550	.566	.15
.15 .20				.371	900	.406	.434	.443	.451	466	179	479	. 491 . 500	509	524	536	.550	.561	569	.586	.25
$.25 \\ .50$		· · ·				.443	471	.480	488 517	.495 523	$500 \\ 529$	.516 $.545$	.528	:.537 .566	.552 .581	.592	.607	.617	.624	639	1.0
$\frac{1.0}{1.25}$		· ::	::					.519	526	532	.538 $.546$	.554 $.562$	0.566	1.575 $1.582$	.590	.601	.614 .622	.625	.641	.656	$\frac{1.25}{1.50}$
$\frac{1.50}{1.75}$		:::	::			::		::		.547	.552	.568	1.580	1.588	602	.614	.628	1.639	,646	$.661 \\ .665$	1.75
$\frac{2.0}{3}$	::		::	: ::	::	::			::			.590	602	.611	.624	.635	.649	.659	.666	$ .680 \\  .689$	3
F 5		::	::			::		::				!		.629	$.642 \\ .658$	.653	.666 .681	.676	.683	.696	5
7.5 10	::	::	::			i		::	::		::				`	.677		.698	.705 .716		
15 20	::		::		::				::					::				.719	.724		
$\frac{25}{40}$	::			::			::	• • •			.:	i ::				::			••	.755	40

If x,  $x_m$  and x' are respectively the beginning of the range, the point at which the ordinates to the two distributions are in the exact ratio of the corresponding groups, and the end of the range,  $\xi$  is the ratio of the distance x to  $x_m$  to the distance x to  $x_m$ .

 $\xi$  is the ratio of the distance x to  $x_m$  to the distance x to x'.

Most of the quantities in the table have been directly calculated, and are less than .0005 in error. The greatest error in the interpolated part of the table will be about .002.

Let h and k be any two small quantities such that  $m'_a = m_a + h$ , and  $m'_b = m_b - k$ , then by expanding and neglecting powers of h and k higher than the first we obtain:—

$$\frac{h}{k} = -\frac{m_a}{m_b} \cdot \frac{\xi_{m_a m_b} - \xi_{m_b m_b}}{\xi_{m_a m_b} - \xi_{m_a m_a}}$$

which shews that if we add (or subtract) any small quantity to (or from)  $m_a$  to get a tabular value we must subtract (or add)  $m_a/m_b$  times the quantity from (or to)  $m_b$  in order to obtain the true value of  $\xi$ This follows from the fact that the  $\xi$  quantity alone is approximately unity in all practical cases, and gives the required quantity by a single interpolation.

If reciprocals be taken of both  $m_a$  and  $m_b$ , the value of  $\xi$  is the arithmetical complement of its value for  $m_a$  and  $m_b$  is:

value for 
$$m_a$$
 and  $m_b$  , i.e. :—  $\xi_{m_a m_b} + \xi_{rac{1}{m_a}rac{1}{m_b}} = 1$ 

<sup>1</sup> It hardly needs to be added that the table must not be entered for one reciprocal only.

15. Absence of climacterics in mortality.—A general impression exists that death is more than normally frequent at some age between the ages of 50 and 60 in the case of males, and an age between 40 and 50 in the case of females. The crude figures for individual years are very irregular, and no precise deduction can be based upon them until they are smoothed. The sums for 9 years (1907-1915) from Australian records are as follows:-

Ages	 48 2841	49 2723 2912	50 3667* 2925	51 2323 2922	52 3071 2926	53 2827 2921	54 2987 2960	55 2903* 2902	56 3010 2938	57 2781 2931
Ages Deaths of Females Smoothed Means .	 	37 1402 	38 1619 1529	$\begin{array}{c} 39 \\ 1540 \\ 1475 \end{array}$	40* 1608 1534	$^{41}_{1206}_{1489}$	$\begin{array}{c} 42 \\ 1695 \\ 1478 \end{array}$	$^{43}_{1396}_{1470}$	$^{44}_{1449}_{1527}$	45* 1673 1493
Ages Deaths of Males Smoothed Means	 58 3011 2930	59 2705 2873	60 3636* 2896	$\begin{array}{c} 61 \\ 2232 \\ 2893 \end{array}$	62 2896 2959	63 2995 3032	64 3068 3182	65 3905* 3260	66 3044 3307	67 3286
Ages Deaths of Females Smoothed Means .	 $^{46}_{1423}_{1534}$	47 1524 1590	$^{48}_{1601}_{1619}$	$^{49}_{1741}_{1593}$	50* 1782 1635	$^{51}_{1319}_{1635}$	52 1733 1584	53 1601 ••		

<sup>\*</sup> If the errors be supposed to accrue mainly through ages 1 and 2 years above and below the true age, the true value can be found approximately by taking the mean of 5 years, since the results are usually linear for small ranges of age. The excess over this can then be distributed among the ages plus and minus 1 and 2, according to the probabilities of the ease. The general trend can then be found. One-third of the excess over one-fifth was added to the age below, one two-thirds to the age above. The quinquennial means so corrected were formed, and are as given opposite "smoothed means."

The instances where the age ends in the integers 0 and 5 shew the usual defect, viz., a tendency to give approximate ages ending in those numbers. When the necessary distribution of the excess, however, is effected no indication exists of climacterics (marked in the death-rates of males or females) in the range shewn. This is evident from the following rates deduced from the adjusted population results of the Census, after making allowance for the difference from the mean of the 9 years included, 1 viz.:

Ages (Males) Death-rates' Smoothed			51 0138 0138				55 0183 0180			$\begin{array}{c} 58 \\ 0241 \\ 0240 \end{array}$	$\begin{array}{c} 59 \\ 0255 \\ 0253 \end{array}$			$\begin{array}{c} 62 \\ 0319 \\ 0318 \end{array}$			$\begin{array}{c} 65 \\ 0404 \\ 0402 \end{array}$	
Ages (Females, Death-rates' Smoothed	38 00607 00598	39 00598 006 <b>1</b> 3	40 00635 00628	$\begin{array}{c} 41\\00632\\00643\end{array}$	$\begin{array}{c} 42\\00645\\00658\end{array}$	43 00658 00673	$\begin{array}{c} 44\\00701\\00690\end{array}$	$\begin{array}{c} 45 \\ 00702 \\ 00711 \end{array}$	46 00740 00738	47 00789 00773	$\begin{array}{c} 48 \\ 00830 \\ 00818 \end{array}$	49 00852 00873	$\begin{array}{c} 50 \\ 00924 \\ 00928 \end{array}$	51 00991 00983	$\begin{array}{c} 52 \\ 01031 \\ 01038 \end{array}$	53		

It is worthy of note that the actual number of deaths of males oscillates very little on either side of the average, 2921, between the ages 49 and 62; and also that the actual number of deaths of females between the ages 38 and 45, and between 45 and 52, oscillate but small amounts on either side of the averages, viz., 1499 and 1598 respectively. The death-rates of course all increase appreciably.

16. Fluctuations of the ratio of female to male death-rates according to age. The average ratio of the female rate of mortality to the male rate of mortality for 1886 to 1915, according to age, is given in the final column of Table CXXXV., p. 375, and this ratio for the death-rate for all ages is

and females respectively

<sup>&</sup>lt;sup>1</sup> The ratio of males and females as at the Census of 1911, and for the sum of the

mean populations, gave the following results:—

Sum Mean Male Populations 1907-15+ Males at Census 1911 = 21,150,358 ÷ 2,313,035 = 9.143985

"Female ", "+ Females ", " = 19,620,889 ÷ 2,141,970 = 9,160207

The divisors used to obtain the mean numbers were 9.1440 and 9.1602 for males

given in Table CXXXVI., p. 376. It is analysed in Table CXXXVII. p. 377. The fluctuations with time of the rates according to age are shewn in the following table:—

TABLE CXLV.—Shewing the Variation in the Ratio of Female to Male Mortality-rates according to Age; 1886 to 1911. Australia.

AGE-GRO	uP.		Еро	СН.		AGE-		EPOC	сн.	
		1886.0	1896.0	1906.0	1911.0	GROUP.	1886.0	1896.0	1906.0	1911.0
0		.864	.975	.826	.803	40-44	.882	.812	.813	.763
1		.958	.938	.933	.818	45-49	.793	.763	.728 .686	.709 .695
$\frac{2}{3}$		.969	.981	.932	.896	50-54	.752	.733		
3		.936	.982	.934	.933	55-59	.727	.731	.716	.684
4		.936	.982	.929	.996	60-64	.725	.739	.741	.686
0-4	!	.887	.867	.844	.824	65-69	.800	.721	.769	.742
5-9		.924	.945	.905	.913	70-74	.830	.803	.801	.792
10-14		.929	.877	.891	.884	75-79	.855	,853	.792	.840
15-19		.769	'861	.907	.862	80-84	.949	.863	.809	.867
20-24		.753	.826	.902	.935	85-89	.892	.843	.834	.810
25-29		.898	.900	.989	1.002	90-94	1.154	.984	.963	.937
30-34	.:	.913	.954	.976	.936	95-99	.715	1.225	1,139	.979
35-39		.969	.939	.944	.880	100-104	.770	1.187	1,163	.949
0-4		.887	.867	.844	.824	15-49*	.854	.865	.894	.870
5-14*		.926	.911	.898	,897	50-89*	.816	.786	.769	.765

<sup>\*</sup> Average of rates merely.

The results in the table shew that, on the whole, there is a decrease in the ratio of the death-rates for females, *i.e.*, the environment or its effect has become more favourable in the case of females than in the case of males in Australia. This result is well defined for ages 0 to 4; fairly well-defined for ages 5 to 14, and is not well defined for later ages. Moreover for all ages the results are rather irregular. The reciprocal of this ratio, viz., the male divided by the female rate for the years 1907-1915, is given in Table CXLVI. hereinafter, and is shewn on Fig. 101 by curve E.

17. Rates of mortality as related to conjugal condition.—The effect of conjugal condition upon death-rates is well marked, and is shewn in the following table, based upon three years' results, viz., 1910-1912. For convenience of comparison the mortality results for nine years for all males and all females is repeated¹ in the table, the masculinity ratio between the death-rates being also given; see curve E, Fig. 101. The ratio of the death-rate of the "not married" to that of the married fluctuates considerably from age-group to age-group, both for males and females. For males between 20 and 85 years of age the death-rate is considerably higher for the "not-married." For females the advantage lies with the "not married" until the child-bearing period has been passed, after which it lies with the "married." The exact age at which the death-rates become equal in the case of females is probably about 43 years.

<sup>&</sup>lt;sup>1</sup> These results were given in Table CXXXV., p. 375, and the average "femininity" of the death-rate was also given for each age-group.

TABLE CXLVI.—Shewing in Age-groups the Average Death-rates of all Males and all Females, 1907-1915, and of Married and Unmarried Males and Married and Unmarried Females, 1910-1912. Australia.

Age- Group.	Age.		7-1915. ty Rate.	Ratio Male to	Moi	rtality, M 1910-191	ales, 2.	Morta 1	lity, Fem 910-1912.	ales.
Group.		Males.	All Fe- males.	Fe- male Rate.	Married.	Not Married. (u)	Ratio.	$\max_{\boldsymbol{m}'}$	Not Married. u'	Ratio.
0 1 2 3 4 4 4 5-9 15-19 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85-89 90-94 90-94 100 &over All ages '	0.43 1.46 2.48 3.49 4.9 1.98 7.42 12.60 17.58 22.49 27.46 32.50 37.50 42.51 47.47 52.39 57.45 62.48 67.46 72.41 77.27 86.96 91.88 96.70	.08540 .01559 .00642 .00409 .00301 .00222 .00173 .00256 .00364 .00431 .00508 .00666 .00841 .012153 .03174 .04678 .06972 .10900 .16815 .2678 .309 .391 .113	.01389 .00575 .00382 .00300 .00202 .00153 .00221 .00341 .00432 .00475 .00586 .00641 .00794 .01050	1.2445 1.2226 1.1153 1.0712 1.0037 1.0949 1.1315 1.1597 1.0699 .9984 1.1368 1.4101 1.4394 1.4615 1.4578 1.3479 1.2624 1.1837 1.2649 1.1927 1.0669 1.1927 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.1937 1.2624 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2636 1.2		.01034 .00251 .00378 .00504 .00682 .00896 .01099 .01535 .01917 .02709 .03614 .05266 .08364 .13670 .20613 .2199	0.977 1.549 1.532 1.684 1.589 1.665 1.477 1.363 1.264 1.1243 1.275 0.883 0.924		.00858 .00215 .00321 .00390 .00499 .00506 .006094 .01237 .01778 .02416 .03766 .07483 .11829 .14664 .2385	0.554 0.768 0.859 0.890 0.821 0.947 1.162 1.219 1.152 1.067 1.351 1.265 1.265 1.265

The "married" include "widowed" and "divorced."

The graphs of the ratios of the death-rates of the "not-married" to the death-rates of the married are curve G for males, and curve F for females, Fig. 101.

18. **Exact ages of least mortality.**—The ages of least mortality appear to vary slightly, but cannot be ascertained with a very high degree of precision, owing to the limitations of the data. They may be taken, however, to be as follows:—

+ or (900) 00001 00000 00000 00000	Males (Year) Exact Age Death-rate General trend (.889) (.896)	1886.0 12.0 .00232 .00232 .00231	1896.0 11.8 .00213 .00206 .00207	1906.0 11.0 .00178 .00183 .00185	Females (.830) (.823)	1886.0 12.0 .00223 .00223	1896.0 12.2 .00178 .00185	1906.0 10.6 .00159 .00154 .00152
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<sup>\*</sup> Allowing twice the weight to the ratio for the 20-years period to that for the 10-years period.

† Allowing equal weight to the 20-years and 10-years periods. This result is less probable than the former.

These results, deduced from the values given in the Life Tables of the Australian Census, Vol. III., pp. 1209 to 1218, are probably nearly correct, and indicate a minimum mortality at "exact age" 11.6 for both males and females, and not only a less mortality, but also a greater improvement in the case of females: the factors for 10 years being respectively 0.889 and 0.830. These for 25 years would be respectively 0.745

and 0.628. The ratios of female to male deaths were—from the data—0.961, 0.836, 0.893; from the general trend—0.961, 0.898, 0.843. Thus the improvement increases at the rate indicated by multiplying by 0.99362 per annum, or by 0.938 for a 10-year period, that is as 0.959, 0.899, 0.843, at 1886, 1896 and 1906.

19. General theory of the variation of mortality with age.—From time to time attempts have been made to present a rational theory of the variation of the death-rate with age. On the other hand it has been held that such attempts are merely efforts to clothe what is really an empirical "fitting of the curve," with a rational guise. It is certain, however, that, in a general way, the aggregate of the menaces to life may be subsumed under certain elementary conceptions, which we now proceed to indicate. Actuaries have adopted the term "force of mortality," to denote the death-rate at a given age (i.e., between the ages x and x + dx). This may be deemed to be composite, and to consist of several forces of mortality which, operating over a considerable range of ages, have their maximum effect, however, at different ages. Thus the deaths  $D_x$  of persons whose ages are (sensibly) x, in a population  $P_x$  of the same age (within the same limited age limits) is:—

(628)..... 
$$D = P(\mu' + \mu'' + \mu''' + \text{etc.}) = P\mu$$

(with the same suffix—denoting age—throughout).

The following conception of the nature of the life-and-death struggle of a living organism represents the phenomena in a general way.<sup>3</sup>

(i.) The plasticity of an organism, *i.e.*, its modifiability in reacting to its environment, is a maximum at its origin,<sup>4</sup> and continually diminishes during life;

¹ Prof. Karl Pearson, adopting the "Vision of Mirza" conception, suggests an analysis by means of systems of progressive elimination, viz., first of deaths due to "old-age mortality," then those due to other elements, and finally those due to infantile mortality. He divided the deaths into five elements, viz. (i.) those from old-age mortality (mode, at age 72½, mean, age 67½); (ii.) those from middle-age mortality (mode, age 42); (iii.) those from mortality of youth (mode, age 23); (iv.) mortality of childhood (mode, age 23); and (v.) infantile mortality. This last should start—so it is averred—at — 0.75, i.e., nine months before birth. The "recorded deaths" are the post-natal, which to the ante-natal are as 246: 605. See K. Pearson, "The Chances of Death," etc., Vol. I., 1897, pp. 1-41.

<sup>&</sup>lt;sup>2</sup> Prof. Harald Westergaard says:—(See his paper on the "Scope and Method of Statistics," Journ. Americ. Stat. Assoc., Vol. XV., Sept., 1916, p. 254):—"Several mathematicians have erred in thinking that it would be possible to find a mathematical law of mortality, a physiological law, as it were. We have several formulas of this kind, by Lambert, Moser, Gompertz, Makeham. For a certain period of life Makeham's formula is exceedingly practical, but after all it is only a beautiful formula of interpolation."

<sup>&</sup>lt;sup>3</sup> It may be added that the similar problem *in utero*, though important to physiologists, can be solved only when a sufficient number of women, having become competent and interested observers of their own careers, supply the necessary data.

<sup>4</sup> This is probably a measure of the rapidity of metabolism in the organism.

- (ii.) In virtue of its plasticity an organism is both *vulnerable* and *recuperable*.
- (iii.) On "birth," i.e., on the introduction into a new environment, the inimical force, i.e., the difficulty of adjustment to the new environment, is very great, but this difficulty diminishes continually and with great rapidity. The initial difficulty of adaptation to the new environment may be called the natal force of mortality.
- (iv.) This falls off so rapidly that it may be regarded as operating for the very limited number of days<sup>1</sup> that constitute what may be called the initial or *natal adaptative effort*.
- (v.) The adaptation having been established, a new condition supervenes during which the mortality is markedly less, and characterises what may be called the *infantile adaptative* effort, covering roughly the first twelve months of life.
- (vi.) The inimical force, now greatly diminished as a consequence of successful initial adaptation, may be called the *infantile* force of mortality. This, like the natal force of mortality, also degrades, but nothing like so rapidly.
- (vii.) Since organic life is maintained in virtue of its plastic endowment (adaptability to its environment) the inimical forces (or measure of the difficulty of adaptation) increase continually from the moment of birth (or more strictly from the moment of origin in utero). This growing incapacity for adaptation may be called the senile force of mortality.
- (viii.) The pressure put on the organism of social life (education, etc.), and by the arising of puberty, and the assertiveness of the reproductive forces, constitute an inimical force, characteristic of the period of life commencing in childhood and vanishing at the end of the disturbing (reproductive) period. This may be called the *genesic force of mortality*.

So far the consideration has embraced both sexes, but in the case of the female another force must be assumed, when a differentiation between reproductive and non-reproductive females is taken into account, viz., the following:—

(ix.) The exhaustion and general dangers of reproduction, initiating on reaching puberty, and continuing till the end of the reproductive period, constitute an inimical force which may be called the *gestate force of mortality*.

<sup>&</sup>lt;sup>1</sup> From what has preceded, see § 11 of this part, it would appear that this is about 5 days.

(x.) There exist also dangers to life which are of a purely casual nature. The aggregate of these may be called the *adventitious force of mortality*. This, however, probably need not be separated from the other forces of mortality. <sup>1</sup>

These several forces of mortality can be so evalued as to be additive in character, as in formula (628), so that the (average) aggregate force of mortality is their sum. This aggregate of inimical forces thus gives the measure at any age of the force determining the rate of death for persons of the age in question. We shall later refer again to this element. We may also suppose that there are in addition what may be called special forces of mortality. The indication given may be regarded as the condition of things when general hygiene is fairly satisfactory throughout life. Not only, however, do individual instances differ from this, but so also do the characteristics of particular communities. <sup>2</sup>

¹ The conception of life as a play between conservative and inimical forces has been presumed by some to be inadequate. Thus although the rapid diminution of the "natal" and "infantile" forces of mortality may be supposed to measure the quick and slower elements of the adaptation attained, the "secular" force of mortality specially characteristic of old age, to measure the decrease of adaptability, and the "genesic" and "gestate" forces of mortality—analogous to one another—to measure the stress put on the organism by the play of the reproductive function, and its consequential effects, entering as it were, as a disturbing factor the effect of which ultimately vanishes, yet there is another factor, acting throughout life, which, as Gompertz considered, is apparently independent of the progressive deterioration with age of the organism, and of course independent also of its adaptativeness. This chance element, viz., the "adventitious force of mortality," would, of course, include death by accident or misadventure, is certainly not a constant; it is a function of age, and differs strikingly as between the sexes. The real vicissitudes of life of a chance nature are, however, not on the average uniform, and probably are not very dissimilar in relative frequency to the relative frequency of death from such causes as have already been indicated. To the extent this is so they may, of course, be regarded as embraced in the other inimical forces.

In considering the whole question, it is to be remembered that we are not really dealing with individual lives, but with a multiplex-organism, viz., an aggregate of lives or population; and we are measuring the progressive reduction of that organism by the elimination of theoretically infinitesimal elements (removal by death). And from this point of view it is obviously very doubtful whether the conception of an adventitious force of mortality is necessary at all, and it is certain that to the extent the relative frequency conforms to the other types of inimical forces it may be regarded with advantage not as merely masked by, but included in them. Prof. Westergaard says, however, op. cit., p. 254: "If we seek a formula for the combined effects of all the causes in action, we run the risk of overlooking some, which it would really be exceedingly important to take into consideration."

<sup>2</sup> In Saxony, for example, the mortality apparently falls till the eighth day after birth after which there appears to be a recrudescence of mortality till the fifteenth or sixteenth day before the final continuous fall of the infantile mortality. In Sweden the mortality shews a less marked and irregular recrudescence till the twelfth or thirteenth day. In Australia the rapid fall continues till the end of the fourth or fifth day, then continues at somewhat the same rate for twelve months. Thus for the period of high infantile mortality Australia seems normal for good infant hygiene, Sweden more normal than Saxony, and Saxony abnormal, i.e., the infant hygiene is probably not at all good. From this it is obvious that each large population will probably have to be treated independently in regard even to the form of the curve representing the earlier stages of the force of infantile mortality. This has already been shewn, see pp. 389-392.

The Gompertz-Makeham-Lazarus theory of mortality.—In 1825, B. Gompertz, suggested that death was possibly "the consequence of two generally coexisting causes," viz.: (i.) Chance, without previous disposition to death or deterioration; and (ii.) Deterioration, or lessened ability to withstand destructive agencies. Assuming that exhaustion of the resisting power to disease proceeds in constant ratio for equal increments of age, that is, that the force of mortality increases in geometrical progression, he deduced his well-known formula, viz. :-

$$(629).....\mu_x = -\frac{1}{l_x}.\frac{dl_x}{dx} = Bc^x$$

B and c being constant, independent of the age (x), and determinable from the data of a mortality table,  $l_x$  being the number living at the age x, and  $dl_x$  the change in  $l_x$  in the time (i.e., change of age) dx.

In January 1860, Makeham, having examined a number of mortality tables for the ages 20 to 80, found it was necessary to modify the Gompertz formula. He shewed that, for the age-period mentioned, the socalled "force of mortality,"  $\mu_x$ , as given in several mortality tables, could be closely represented without changing the constants of formula (629) by adding a constant A, viz., by an expression of the form :—

$$(629a)\ldots \mu_x = A + Bc^x.$$

in other words, the force of mortality, assumed by Gompertz to be a geometrical progression, should, according to Makeham, be represented by a geometrical progression plus a constant.

$$l_x = e^{k + be^{cx}} = dgq^x$$
 where  $d = e^k$ ,  $g = e^b$ ,  $q = e^c$ 

Later, viz., 1839, Ludwig Moser published in Berlin his "Die Gesetze der Lebensdauer.

Gompertz shewed that if the chance of disease were equal at all ages, and if its effect were independent of age, then it would follow that the number of living and dying, as the age increased in arithmetical progression, would decrease in geometrical progression. But, if liability to death increased with age, the number living would diminish faster than in geometrical progression. He observed that, although the hypothesis was not an "unlikely supposition with respect to a great part of life, the contrary appears to take place at certain periods"; see his paper "On the Nature of the Function expressing the Law of Human Mortality," read before the Roy. Soc., Lond., 16th June, 1825, and appearing in the Phil. Trans., 1825, pp. 513-585. He had given an earlier paper (June 29th, 1820) at the same society, entitled "A Sketch of an Analysis and Notation applicable to the Estimates of the Value of Life Contingencies." Phil. Trans., Pt. I., 1820, pp. 214-294. This obviously led to the later ones; see also a supplement to both read 20th June, 1861, and published in the Phil. Trans., 1862, Vol. 152, pp. 511-559. Prof. De Morgan discussed Gompertz's view; see "On a Property of Mr. Gompertz's Law of Mortality," Journ. Inst. Actuaries, Vol. VIII., July 1859, pp. 181-184; and also Phil. Mag., Nov. 1839. To represent number living at age x, Prof. De Morgan used:—  $l_x = ek + be^{ex} = dx^{ax}$  where d = ek, a = eb, a = eb<sup>1</sup> Gompertz shewed that if the chance of disease were equal at all ages, and

Later he discovered that a further modification, viz., the introduction of a term Cx, that is, an arithmetical progression, gave the formula a wider extension. Thus his second modification was the expression:—

$$(629b)\ldots \mu_x = A + Cx + Bc^x.$$

The significance of expressions of this type is seen at once from (630) hereinafter, that is:—

(629c).. 
$$\log_e y = -\int Bc^x dx = K - \frac{B}{\log c} c^x$$
; or  $y = kg^{e^x}$ 

according to Gompertz; or

(629d). 
$$\log_e y = -\int (A + Bc^x) dx = K - Ax - \frac{B}{\log c} c^x$$
; or  $y = ks^x g^{e^x}$ 

according to Makeham's first modification of Gompertz's formula; and

(629e).. 
$$\log_{e} y = -\int (A + Cx + Bc^{x})dx = K - Ax - \frac{1}{2}Cx^{2} - \frac{B}{\log c}c^{x};$$
  
or  $y = ks^{x} h^{x^{2}} g^{e^{x}}$ 

according to Makeham's second modification.

In these K is merely an integration constant, and is equal to  $\log_e k$ , and  $\log_e g = -B/\log_e c$ ;  $\log_e s = -A$ ;  $\log_e h = -\frac{1}{2}C$ .

More recently Wilhelm Lazarus, of Hamburg,  $^1$  and later Vitale Laudi,  $^2$  of Trieste, in order to embrace results for earlier ages, abandoned the arithmetical progression represented by the term Cx, and introduced in its place a second geometrical progression making the form of the instantaneous rate of mortality.

$$(629f)....\mu_x = A + Gb^x + Bc^x.$$

C. H. Wickens has shewn that, for Australia, infantile mortality from birth to age 5 is well expressed by a formula of the type of Makeham's second modification of the Gompertz formula <sup>3</sup>; see also § 20 hereinafter.

An expression is general, however, if it cover the whole range of life with the one series of constants for any particular epoch: this none of the formulæ will do with the number of terms adopted. Before further developing the matter we shall consider the nature of a constant population, the death-rates of which are also constant.

<sup>&</sup>lt;sup>1</sup> See Uber Mortalitätsverhältnisse und ihre Ursachen, Hamburg, 1867. Lazarus' paper was translated by T. B. Sprague, M.A.; see Journ. Inst. Act., Vol. XVIII., pp. 54-61; 212-223. T. S. Lambert published an article on Longevity, in 1869, New York.

<sup>&</sup>lt;sup>2</sup> In a publication, "Die Rechnungsgrundlagen der k.k. priv. Assicurazioni Generali in Triest," a very concise exposition is given of the biologic basis of the fundamental formula under the title" Die biologische Begründung der Ausgleichungsformel nach Lazarus," See § 2, pp. xxiv.-xxix.

<sup>&</sup>lt;sup>3</sup> See "Investigations concerning a Law of Mortality," C. H. Wickens, A.I.A., Journ. Aust. Assoc. Adv. Sc. XIV., pp. 526-536.

21. Theory of an "actuarial population."—Consider an indefinitely large group of persons, who born at a given moment, are then subject to death, the rate of which (governed solely by age) is characteristic of their If this group be neither increased nor environment (and period). diminished by emigration, and as age increases be lessened only by death, the proportion of survivors at each age may be regarded as furnishing the relative numbers of what may be called an actuarial population. A population so constituted plays an important part in actuarial investigations as to the probability of death according to age, and has also been called a " constant population."

Let the ratio of such a population after the period x has elapsed,  $P_x$ say (the members now being all of age x) to the initial population, viz., that at age 0,  $P_0$  say, be denoted by  $y_x$ ; that is, let  $y_x = P_x/P_0$ ; then initially y, or  $(y_0) = 1$  and  $1-y_x$  will denote the ratio of the aggregate of deaths up to the age x.

Let  $\mu = \phi(x)$  denote the rate per unit of time 1 at which death occurs at the "exact age" x; then the number dying in a unit of time, whose ages are between x and x + dx, is the number living between those agelimits, multiplied by the rate of dying, that is,  $y\mu dx$ . Thus if  $\mu$  be regarded as positive

$$(630).....-dy=y\mu dx\,; \text{ or } \frac{dy}{y}=-\phi\;(x)\,dx$$
 By integration we obtain :—

(631).....log 
$$y = -\int \phi(x) dx$$
: or  $y = e^{-\int \phi(x) dx}$ 

Equations (630) and (631) are the bases of the theory of an "actuarial population." The number of survivors at each age obviously depends on the form of  $\phi(x)$ , and is completely determined when that function is known. Various forms that have been adopted for  $\phi(x)$ , and their integrals have already been given, formulæ (629) to (629f).

The probability at birth, of living to age x is  $y_x$ , as given by (631) above. The probability of dying before age  $x(\nu_x, \text{say})$ , is the arithmetical complement of the probability of hving, viz.,  $1-y_x$ ; that is:

$$(632).....\nu_x = 1 - y_x = 1 - e^{-f\phi(x)dx}$$

Similarly the probability  $(p_x)$  of persons of age x living to age x+1and  $(q_x)$  that of dying before that age, are respectively:—

(633)....
$$p_x = (y_{x+1})/y_x$$
; and  $q_x = (y_x - y_{x+1})/y_x = 1 - p_x$ .

The average of the death-rates (M) of persons dying between ages  $x_1$  and  $x_2$  is :-

$$(634).....M = \frac{1}{x_2 - x_1} \int_{x_1}^{x_2} \mu \, dx = \frac{1}{x_2 - x_1} \int_{x_1}^{x_2} \phi(x) \, dx$$

<sup>&</sup>lt;sup>1</sup> Which may be a day, month, year, etc., but is usually a year

When the range of ages is a unit (or 1 year) we shall denote this quantity by the letter (m). The group-rate of mortality (M) for persons dying between the ages  $x_1$  and  $x_2$ , is the ratio of the total deaths between the ages in question occurring in a unit of time, to the average population from which the deaths are drawn; that is:—

(635)... 
$$M = \frac{y_2 - y_1}{\frac{1}{x_2 - x_1} \int_{x_1}^{x_2} y \, dx} = \frac{e^{-\int \phi(x_2) \, dx} - e^{-\int \phi(x_1) \, dx}}{\frac{1}{x_2 - x_1} \int_{x_1}^{x_2} e^{-\int \phi(x_1) \, dx} \, dx}$$

When the group-rate of mortality is taken through a range of age, of one year only, it is known actuarially as the central death-rate (m) of the year in question. In this case  $x_2-x_1$  is unity, and disappears in the above expression, and  $y_2=y_1+1$ . Since through the greater part of life  $\mu$  does not change very rapidly,  $\mu_{x+\frac{1}{2}}$  is approximately equal to  $m_x$ , the group-range being really from exact age x to exact age x+1, and x for a range of x years will—to a very rough approximation—be x.

If, for so small a range of age as one year, it be assumed that the mean population is the mean of the populations at the beginning of, and end of the year of age (which is sensibly correct for a considerable range of the table 1) the following relations hold between m, m, and  $\mu$ :—

(636)..., 
$$m = \operatorname{colog}_e p = -\log (1-q) = q + \frac{1}{2}q^2 + \frac{1}{3}q^3 + \frac{1}{4}q^4 + \dots$$
  
(637)...,  $m = 2q/(2-q) = q_x (1-\frac{1}{2}q) = q + \frac{1}{2}q^2 + \frac{1}{4}q^3 + \frac{1}{8}q^4 + \dots$   
(638)...,  $\mu_{+\frac{1}{2}} = q \pm \epsilon$ 

in which last expression  $\epsilon$  is usually very small, but is not readily susceptible of any general expression, and must be specially determined for the very early and very late stages of life.

The instantaneous rate of mortality  $\mu$ , at any exact age, is, of course, not immediately furnished by statistical data, but has to be deduced therefrom. It is the value of M in equation (634) or of M in equation (635) when  $x_1$  and  $x_2$  become identical.

22. The relation between the mortality curve and the probability of death.—The relation between  $\mu_x$  and  $q_x$  may be established as follows: For any limited range of ages, excepting during the first year of life, the instantaneous mortality may be put in the form  $A + B \mathfrak{m}^{\chi}$ , the integral of which is  $C + A\chi + B\mathfrak{m}^{\chi}/\log_e \mathfrak{m}$ . If three successive values of  $\mu$  for equal changes of age are  $\mu_0$ ,  $\mu_1$  and  $\mu_2$ , then we shall have  $^2$ :—

(639)..... 
$$A = \frac{\mu_2 \mu_0 - \mu_1^2}{\mu_2 - 2\mu_1 + \mu_0}; \quad B = \frac{(\mu_1 - \mu_0)^2}{\mu_2 - 2\mu_1 + \mu_0};$$

$$(640).... m = \frac{\mu_2 - \mu_1}{\mu_1 - \mu_0}; m - 1 = \frac{\mu_2 - 2\mu_1 + \mu_0}{\mu_1 - \mu_0} = m$$

<sup>&</sup>lt;sup>1</sup> See Census Report, Vol. III., pp. 1215-6, for example.

 $<sup>^2</sup>$  For greater precision, three values one place earlier,  $\mu_1$ ,  $\mu_0$  and  $\mu_1$  can also be taken, and the corresponding values of A', B',  $\mathfrak{M}'$  and  $\mathfrak{U}'$  computed, entering the corresponding values of  $\mu$  (the suffixes of which are unity less than those given). Thus for the stretch  $\mu_0$  to  $\mu_1$  the mean of the two results will—in general—be more accurate than either. Geometrically this is very simple;  $\mathfrak{M}$  is the ratio of the differences of the rates of mortality; so long as the differences are in constant ratio the one value  $\mathfrak{M}$  applies.

If the successive values of  $\mu$  are for ages k years apart, then the values of A and B remain unchanged for values one year apart, but the value of m for 1 year,  $m_1$  say, is  $m_1 = m_k^{\frac{1}{k}}$  or  $m_1^k = m_0$ . This quantity is, of course, always positive, being greater than unity for an ascending curve, and less than unity for a descending curve. The use of the quantity n, enables  $\log m = \log (1 + n)$  to be conveniently expanded in the series  $n - \frac{1}{2}n^2 + \frac{1}{3}n^3$ — etc., which is convenient when n is small.

Although the above expression for the curve is simple, yet when the value of the integral is applied to (635) in order to find the average population, it leads to an arithmetically intractable expression. Consequently a direct general expression for  $p_x$  and  $q_x$  is not readily obtained in terms of  $\mu$ . It is usual in actuarial computation to compute the Gompertz-Makeham constants from the values of  $\mu$  and to find p and q from the values of p (that is, from p and p and p from the values of p (that is, from p and p from the obtained in quite another way. Put

$$(641)...q = \gamma q' = \gamma \cdot \frac{1}{2} (\mu_x + \mu_{x+1});$$

then  $\gamma$  is a correction factor to what is ordinarily an approximate value. It can be computed and entered in a double-entry table for a suitable range of values of  $\kappa = \mu_{x+1}/\mu_x$ , and a suitable range of values of  $\mu$ . Such a table would admit of q being readily and accurately found by interpolations, and would simplify the computations of life-tables. Similarly tables could be constructed in which the arguments were  $m_x$ , and the ratios  $\kappa' = m_{x+1}/m_x$ . This, however, will not be dealt with further in this article.

In actuarial notation,  $^2$   $l_x$ , the relative number of persons living at age x is so expressed that  $l_0$  is 100,000, 10,000, or some such large unit;

<sup>1</sup> Put 
$$K = e^{-c}$$
;  $a = e^{-A}$ ;  $\beta = e^{-B/\log_e m}$ , then

 $fe^{-\left\{C+A\chi+B\mathfrak{m}^\chi/\log_e\mathfrak{m}\right\}}dx=Kf\alpha^\chi\beta^{\mathfrak{m}^\chi}d\chi=Kf\,e^{-z}\,d\chi$  Let  $a=\mathfrak{m}^t$  and  $\beta\mathfrak{m}^\chi=e_\chi^{-v}$ , consequently taking logarithms  $\mathfrak{m}^\chi\log_e\beta=\iota$ . Differentiating  $\mathfrak{m}^\chi\log_e\mathfrak{m}\log_e\beta.d\chi=dv=v\log_e\mathfrak{m}\,d\chi$  (by substitution).  $a^\chi=\mathfrak{m}^{t\chi}=(\mathfrak{m}^\chi)^t=(v/\log_e\beta)^t\;; \text{ consequently}$ 

 $\int a^{\chi} \beta^{m\chi} d\chi = \int (v/\log_e \beta)^t \cdot e^v \cdot dv/v \log_e \mathfrak{m} = \frac{1}{(\log_e \beta)^t \log_e \mathfrak{m}} \int e^v v^{t-1} dv;$  the value of the integral being  $e^v [v^{t-1} - (t-1)v^{t-2} + (t-1)(t-2)v^{t-3} - \text{etc.}]$  which gives the required values, if it be remembered that when x = 0, 1, etc.  $v = \log_e \beta$ ,  $m \log_e \beta$ , etc., respectively.

Neglecting the C term we have, however, by expansion,

Meglecomy the C term we have, however, by expansion,  $\int e^{-z} d\chi = \int [1 - A\chi + \frac{1}{2}A^2\chi^2 - \frac{1}{6}A^3\chi^3 + \dots - (\beta + A\beta\chi - \frac{1}{2}A^2\beta\chi^2) \text{im}^{\chi} + \frac{1}{2}(\beta^2 - \frac{1}{2}A\beta^2\chi) \text{im}^{2\chi} + \frac{1}{6}\beta^3 \text{in}^{3\chi} - \text{etc.}] d\chi.$  which can be integrated term by term.

<sup>2</sup> Ordinarily actuarial methods are based upon the algorithms of "finite-differences." The connection between these and infinitesimal methods has been dealt with in a paper entitled "On the relation between the theories of compound interest and life contingencies," by J. M. Allen, F.I.A.; see Journ. Inst. Act., Vol. xli., pp. 305-337; see also discussion pp. 337-348, and particularly that by D. C. Fraser.

 $d_x$  denotes the number of persons dying between ages x and  $x+1\,;\,$  and similarly :—

$$(642).....p_x=\frac{l_{x+1}}{l_x}\,; \text{ and } q_x=\frac{l_x-l_{x+1}}{l_x}\!=\!\frac{d_x}{l_x}$$

(643)....
$$m_x = \frac{d_x}{l_{x+\frac{1}{2}}}$$
; and  $p_x = \frac{2 - m_x}{2 + m_x}$ 

Also, since p and q are arithmetical complements,

$$(644)....q_x = rac{2m_x}{2+m_x}; \; \mu_x = -rac{1}{l_x} \cdot rac{dl_x}{dx} = -rac{d}{dx} \; (\log \; l_x)^1$$

23. Limitations of the Gompertz theory and of its developments.— The conception put forward by Gompertz, and the modifications of that conception by Makeham, have, as already stated, been again modified by Laudi and Lazarus, who, to embrace results for earlier ages, replaced Makeham's result by putting for the value of the number living:—

$$(645)....y_x = l_x = kH^{\beta^x} s^x b^{\epsilon^x}.$$

More recently C. H. Wickens has shewn that a similar type of expression fits ages up to age five.  $^3$ 

These formulæ, however, cannot be made to conform to the whole range of facts, viz., from the earliest to the latest ages, as has already been shewn. Although Mr. Wickens has shewn that, in a general way, a curve of the Gompertz-Makeham type represents the facts for the first few years of life, the formulae given do not conform to the details of the first twelve months of life: in short, it is not consistent with the "natal"

in good agreement with the value 1.1076433 mentioned above for age 1.

Mr. Wickens, putting—
$$A = -\log_e s = \frac{1}{M} (a - \frac{1}{2}\gamma); B = -\log_e c \log_e g = \frac{\beta \log c}{M^2 (c - 1)}; \text{ and }$$

$$C = -2 \log_e h = \gamma/M; \text{ in which}$$

$$a = -(\log s + \log h); \beta = -(c - 1) \log g; \text{ and } \gamma = -2 \log h;$$

M denoting loge, i.e., 0.4342945, gives the result in the form :—

$$\mu_x = 0.00816 - 0.00113x + 0.21971^{0.1} \,^{2453}x;$$
 for males.  $\mu_x' = 0.00645 - 0.00074x + 0.17199^{0.14872}x;$  for females.

the fit being excellent. See also "Assurance Magazine" (Journ. Inst. Act.), Vol. X., pp. 283-5, 1862. (Letter dated 15th August, 1861).

<sup>&</sup>lt;sup>1</sup> It is generally assumed that  $m_x = \mu_{x+\frac{1}{4}}$  approximately, the approximation being quite as accurate as the data. Approximations of greater precision are given in the Text Book of the Institute of Actuaries II., 1887 Edit., p. 25, and by later writers

<sup>&</sup>lt;sup>2</sup>Laudi and Lazarus gave the value 1.291219 to H and 0.4 to b, which give factors that become sensibly unity when x is 15. Thus the term for age 15 is 1.0000000274, and for age 20 is 1.0000000281. For age 1, however, the term is as high as 1.1076433.

<sup>&</sup>lt;sup>3</sup> Mr. Wickens' formula gives for the h term  $(hx^2)$  and for ages up to 5, the following values for h, viz., 1.00056 for males, and 1.00037 for females, which are obviously not in good agreement with the value 1.1076433 mentioned above for age 1.

or "infantile" forces of mortality, as is evident from Fig. 101, p. 319. Formulae of that type can, of course, be made to represent the earlier features of the curve of mortality, viz., the natal and infantile and earlier forces of mortality, that is, the Lazarus-Laudi scheme of addition can be extended, the effect of the earlier terms disappearing when we please. This would give a complete general formula of the type

$$(646) \cdot \dots \cdot \mu_x = a + bc^x + \beta \gamma^x + BC^x + \dots + Sx^s + Tx^t + \dots$$

It will be found hereinafter that a somewhat different conception already outlined in § 19 really accords with the facts, and it may be added that Westergaard's opinion that the formulae are really empirical, is substantially supported by the analysis.

24. Senile element in the force of mortality.—The senile element in the force of mortality may be assumed to operate from birth, with, of course, increasing potency as age advances. Initially it clearly ought to be zero, and thus it can be simply expressed by 1:—

$$(647)$$
..... $\mu_s = Sx^s$ , or  $\log \mu_s = \log S + s \log x$ .

Applying this gives for male and female senile death-rates, respectively:—

$$\text{(648)} \begin{cases} \text{Males} \quad u = 0.0^{13} \ 06100 \, x^{5.9671} \ ; & \text{females} = 0.0^{13} \ 2826 \, x^{6.6189} \ ; \text{ or} \\ \text{,, } \log \mu = \overline{13}.78533 + 5.9671 \ \log x \ ; \ \text{,,} & = \overline{14}.45117 + 6.6189 \ \log x, \end{cases}$$

and they give a common value 0.99844 for the annual rate of mortality at age 111.40 years. These formulæ give the results in columns (ii.) and (vii.) of Table CXLVIII., p. 413. To find log. S we have:—

$$(649)..\log S = \log \mu_1 - \log x_1 [(\log \mu_2 - \log \mu_1)/(\log x_2 - \log x_1)],$$

<sup>&</sup>lt;sup>1</sup> This was decided upon empirically after examining the applicability of other forms. For example, if senile impairment accumulated at a constant rate, it would be expressed by  $Se^{\sigma x}$ . If the accumulated effect accelerated with age, a linear acceleration would require  $Se^{\sigma x^3}$ . Thus the index 2 would be too great if the acceleration were greater than linear, and too small if it were more rapid than linear.  $Se^{\sigma x^3}$  was examined: this gave  $_2\mu_s/_1\mu_s=e^{\sigma(x_2^s-x_1^s)}$  and  $d\mu/dx=S\sigma se^{\sigma x}x^s-1$ . The value of  $\sigma$  may be readily found by means of a table of values of the x term (in brackets) for various values of s. Taking S=.0021852,  $\sigma=0.00064$ , and s=2 gave, for "persons"

The result is obviously too high for early ages, when s was made unity. Formulæ of the type  $Sx^{\sigma x}$  are inappropriate between 0 and 1, because  $x^x$  has a minimum at x = .03678794, i.e., 1/e, when its value is 0.6922007.  $S(e^{\sigma x} - 1)$  would, however, probably be satisfactory from age 1 onwards.

s being the quantity in the square brackets. It would probably be preferable to adopt a mortality curve for the older ages, passing *among* the

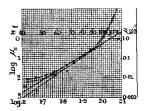


Fig. 102.

The curves shew the senile element in mortality.

points given by the relatively meagre and uncertain data, than to follow them closely, since the general indication is probably the more reliable.

The fit of the formula to the data is shewn on Fig. 102, on which the lines represent the logarithmic homologues of the senile curves, the small circles denoting the data for males and the small squares those for females.

## 25. The force of mortality in earlier

childhood.—The rates of mortality from age 1.5 to 7.5 were as follow from 1907-1915 in Australia:—

No elementary function will satisfactorily represent these results with precision. The following results, however—empirically found—reproduce the data almost exactly, and shew the fluctuating character of the value of  $e^{-b}$  in the expression  $e^{-bx}$ , which would represent the curve:—

TABLE CXLVII.—Rates of Mortality in Childhood. Australia, 1907-15.

Exact Age.	Males.	Females	Exact Age.	Males.	Females	Exact Age.	Males.	Females
0.5	.07608	.06156	4.5	.00304	.00300	8.5	.00208	.00185
1.0	$.03\overline{104} \\ .500$	02635 $524$	5.0	.00285	00281 $935$	9.0	.00202 .970	.00179
1.5	.01552 $.596$	.01381	5.5	.00268	.00262	9.5	.00196 .970	.00174
2.0	00925 $692$	$0.00842 \\ 0.681$	6.0	.00253	00245 $935$	10.0	.00190	.00169
2.5	.00640 $.762$	00574 $.772$	6.5	.00240	.00229	10.5	00184 $.970$ $.00179$	00164 $.970$ $.00159$
3.0	.00488	.00443	7.0	.00229	.00214	11.0 $11.5$	.00179	.00159
3.5	.00406	.00382	7.5	.00221	$00201 \\ 0955 \\ 00191$	12.0	1.000	1.000
4.0	.00346	.00335	8.0	.00214	.965	12.0	.00175	.00104

Note.—The small figures are the ratios which multiplied into the values immediately above them give those immediately below.

which show that 1+f(x) is not expressible by any simple relation. The results for males for  $2\frac{1}{2}$ ,  $3\frac{1}{2}$ , and  $4\frac{1}{2}$  years can be expressed by  $\mu_x = \mu_0 e^{-ax^2}$ , and for females this expression is also fairly approximate.

<sup>&</sup>lt;sup>1</sup> We have seen in § 11 that, for the greater part of first year of life,  $\mu = \mu_0 [1+f(x)]/x$ , and that toward the end of the first year f(x) is large—about 4—compared with unity. Also it is evident from curve A', Fig. 101, that it is approximately a constant at about 320 days to perhaps 400 days, thus  $\mu = 5\mu_0/x$ , and would appear to have become constant at least for some range of x. Such, however, is not the case. If it were we should have  $x\mu_x = k[1+f(x)]$  a constant. We obtain, however, the following results:—

26. Genesic and Gestate elements in mortality.—If the infantile and juvenile, and the senile elements of the mortality be subtracted from

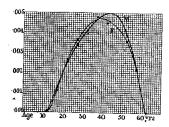


Fig. 103.

The curves shew the genesic (M) and gestate (F) elements in mortality.

the totals, the residuals will constitute the genesic element in the case of males, and the gestate elements in the case of females. The rate of diminution seemed to be constantly 0.97 per half-year (see Table CXLVII., p. 412) from age 8.5 to 11.5 for both sexes. This is equivalent to 0.73752 for 5 years, and the adoption of this gives the results in columns (iii.) and (viii.) of Table CXLVIII. This may be regarded as the measure of degradation of the power of adjustment to environment. The residuals smoothed as shewn on Fig. 103, are given in columns (iv.) and

(ix.). On this figure the heavy curve, M, denotes results for males, and the light one, F, results for females. The computed mortality curves and those given by the crude data, are shewn in columns (v.) and (vi.) for males, and columns (x.) and (xi.) for females. The agreement in general is fair up to 62.5 years. Afterwards the results diverge somewhat. It has, however, to be remembered that these divergencies are not really large, and do not make large differences as between the computed and actual numbers of deaths.

TABLE CXLVIII.—Illustrating the component-elements of the Force of Mortality.

Australia, 1911.

		Male	Rates of	Mortalit	y, × 100	0,000	Fema	le Rates o	f Mortal	it <b>y</b> , × 10	00,000.
		Senile	Juvenile			otal.	Senile	Juvenile	Gestate		tal.
		Element.	Element.	Sm'thd.		ob- served.	Element.	Element.	Sm'thd.	(Com- puted.)	Ob- serve d.
(i.) 2.5 7.5		(ii.) 0 0	(iii.) 640 221	(iv.) 0 0	(v.) 640 221	(vi.) 641	(vii.)	(viii.) 574	(ix.)	(x.) 574	(xi.) 574
$12.5 \\ 17.5$	• •	0	$163 \\ 120$	10 133	$173 \\ 255$	220 173 255	0 0	$\begin{array}{c} 201 \\ 149 \\ 110 \end{array}$	0 4	201 153	200 153
$\frac{22.5}{27.5}$		$\begin{array}{c}2\\7\\24\end{array}$	89 65	252 343	348 432	364 432	3 10	81 60	$\frac{120}{268}$	230 352 436	220 341 433
$\frac{32.5}{37.5}$	• •	64 151	48 36	$\frac{413}{467}$	$\frac{525}{654}$	508 666	$\frac{29}{74}$	44 33	$\frac{435}{467}$	508 574	475 586
$\frac{42.5}{47.5}$	• • •	318 617	$\frac{26}{19}$	497 484	$\begin{array}{c c} 841 \\ 1,120 \\ \end{array}$	841 1,122	170 354	$\frac{24}{18}$	$rac{462}{426}$	656 798	641 796
$52.5 \\ 57.5 \\ 62.5$	• •	$1,121 \\ 1,930 \\ 3,173$	14 11 8	$\frac{387}{220}$	$1,522 \\ 2,161 \\ 3,184$	$1,522 \\ 2,161 \\ 3,179$	$\begin{array}{c} 686 \\ 1,254 \\ 2,177 \end{array}$	$^{13}_{10}_{7}$	$\frac{356}{215}$	1,055 $1,479$	1,057 $1,479$
67.5	 	5,022	6	0	5,028	4,693	3,623	5	3	$\frac{2,187}{3,628}$	2,181
$72.5 \\ 77.5$		$7,693 \ 11,455$		0	7,697 $11,458$	$7,034 \\ 11,136$	5,814 9,041		0	5,818 $9,044$	2,201 5,580 9,379
$\begin{array}{c} 82.5 \\ 87.5 \end{array}$		16,635 23,632	$egin{array}{c} 4 \\ 3 \\ 2 \\ 2 \\ 1 \end{array}$	0 0	$16,637 \\ 23,634$	$ \begin{array}{c} 17,387 \\ 27,557 \end{array} $	13,674 20,188	4 3 2 2	ŏ	13,676 $20,190$	15,026 $22,492$
92.5 97.5	::	33,926 45,071	1	0	33,927 $45,072$	31,673 40,475	29,161 41,314	1 1	0	$\frac{29,162}{41,315}$	30,007 39,873
02.5	• •	60,744	1	0	60,745	1.23393	57,531	1	0	57,532	1.16876

27. Norm of mortality-rates.—A study of mortality rates for the same country at different times, and for various countries, shews that the real nature of the mortality curve will probably be revealed only by

obtaining a norm of mortality rates on a wide basis. Such a norm would necessitate a compilation for a large series of populations, of the following data, viz.:—

- (a) Infantile deaths according to hours for the first week of life; then according to days for the first month of life: and according to weeks for the balance of the year.
- (b) Deaths in childhood according to months for the second year; and according to quarters for the third year and afterwards;
- (c) annually—or better semi-annually—till 15.

Afterwards the annual number of deaths.

The "number living" would preferably be deduced for the first 12 months (making corrections, however, for migration), by subtracting the deaths from the recorded births. Afterwards, or at any rate after the second year, the census data would in most cases be preferable to use.

The combination of a large number of results, viz., all deaths in any age-group, and the sum of the populations in the same age-group from which such deaths were drawn, would probably disclose the true laws of the incidence of death. Only in large bodies of figures can it be hoped that the minor chance influences will counteract one another.

- 28. Number of deaths from particular causes.—The actual numbers of deaths according to sex and age, which occurred in Australia during the 9 years 1907-1915 from various causes, were as shewn in the following table, viz., No. CLXIX., their relative frequency from all causes together, but retaining the age-groups, that is their ratios to the totals for the same sex, being shewn on the last two lines, see pp. 416-417:—
- 29. Relative frequency of deaths from particular diseases according to age and sex.—If for each sex and for each age-group in that sex, the number of deaths from each cause be divided by the total deaths from all causes, the quotients are the relative positions of the disease as regards their contribution to the totality of deaths. Thus they measure the gravity of the incidence of any disease in question. This has been done and the results are shewn in Table CL., on pp. 418-419.

30. Death-rates from particular diseases according to age and sex.—
It has already been pointed out that the incidence of death according to sex, has diverse characters as regards its relation to age; see § 12, p. 393 hereinbefore. If the ratio of the number of deaths which occur in one year from any disease, in any age-group, and for either sex, to the average number of persons of the same sex in the age-group be found, this ratio will be the annual death-rate for the particular disease in question. Thus the ratios are exactly analogous to the values with accents in (628) of § 19, p. 402; that is, they are the individual components of the death-rate for the same sex and age-group. They represent the ratio of the number of persons of a particular age-group who will (probably) die of the particular disease in question during the one year. These ratios, multiplied by 1,000,000, are shewn in Table CLI. and are thus the (partial) death-rates for each disease and for the two sexes, see pp. 420-421.

The forms of the rate-of-mortality curves for each disease are shewn on Fig. 104, the heavy lines denoting the curves for males and the lighter line those for females. They illustrate the marked differences in the incidence of death as between the sexes for the same disease, and according to age as between different diseases.

31. Rates of mortality during the first twelve months of life.—The incidence of death during the first twelve months of life is so varied that the means for the successive years 0, 1, 2, 3, etc., cannot be regarded as giving a satisfactory indication in regard thereto. Even in the first month of life, the frequency of deaths greatly varies for the successive weeks therein, so that a month is clearly too large a unit to adopt for rigorous results. Consequently, a tabulation for the first four weeks is necessary as well as for each of the succeeding eleven months. The population on which the ratios were based was 399,823 male births, and 38,027 females, which was reduced by the deaths themselves and increased by the net immigration of the same sex. <sup>2</sup>

<sup>&</sup>lt;sup>1</sup> The sum of the mean populations for each sex and for the 9 years under review were distributed according to the Census of 1911, the middle year. This gave the divisors by means of which the rates were computed.

<sup>&</sup>lt;sup>2</sup> The immigration is by no means wholly negligible for accurate results: thus it was estimated to be—for each sex—267 for the eleventh to the twelfth month, while the deaths were: males, 933; females, 768. Its neglect does not, however, obviously make a large error, since the deaths are drawn mainly from those born in the country under consideration.

	•	[AB]	LE CX	LIX.	—Act	ual N	<b>Tum</b> b	er of	Dea	ths ir	ı Au	strali	ia acc	cordin	g to (	Cause,	Age,	and S	lex, d	uring	9 Yea	rs, 19	07-191	L5.				
															AGES.										_			
	CAUSE	Sex	0	1	2	3	4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89	90 to 94	95 to 99	100 and over	Total.
1	Typhoid Fever	M F	 8 5	10	8 14	16 18	14 17	88 84	134 203	390 346	732 348	653 263	418 168	$\frac{325}{134}$	238 99	196 82	127 58	$\frac{71}{34}$	50 15	28 16	13 13	6	3 1	13	0	0	0	3,529 1,928
5	Measles	M F	$\frac{209}{171}$	315 240	$\begin{array}{c} 146 \\ 108 \end{array}$	56 62	34 35	100 103	$\frac{19}{24}$	25 30	60 18	19 20	15 16	7 17	4 11	$^{8}_{12}$	11 6	6 5	1 3	$\frac{3}{2}$	3	1	2	0 1	0	0 0	0	1,044 888
7	Whooping Cough*	M F	$1,127 \\ 1,263$	359 406	101 157	49 65	$\frac{27}{31}$	44 61	1 3	0	0	$\frac{1}{2}$	0	0	0	0	0	$^1_2$	1	1	0	3	0	0	0	0	0	1,715 1, <b>9</b> 94
8	Diphtheria and Croup	M F	183 134	380 309	370 338	405 324	301 309	787 961	186 209	52 70	$\frac{20}{26}$	$\begin{array}{c} 17 \\ 20 \end{array}$	10 11	$\frac{8}{12}$	7 8,	3	4 5	5 2	2 3	1	0	2	0	0	0	0 1	0	$2,744 \\ 2,747$
9	Influenza*	M	18 <b>3</b> 129	41 41	17 18	$\frac{16}{12}$	11 5	34 43	$\begin{array}{c} 17 \\ 28 \end{array}$	44 37	52 63	62 49	42 45	79 69	$\begin{array}{c} \bf 94 \\ \bf 53 \end{array}$	$\frac{124}{68}$	108 80	112 66	$\frac{116}{119}$	171 174	$\frac{228}{246}$	$\frac{243}{290}$	$\begin{array}{c} 178 \\ 161 \end{array}$	80 98	36 35	6 9	0 2	2,094 1,940
12	Other Epidemic Diseases	M	135 114	29 19	$^{11}_{16}$	5	7 11	16 12	$\frac{15}{13}$	35 22	80 28	$\frac{91}{31}$	$\frac{57}{32}$	$\frac{61}{13}$	$\frac{72}{21}$	76 43	83 46	67 19	75 <b>4</b> 9	77 58	92 56	$^{72}_{66}$	$\frac{52}{38}$	$\frac{28}{19}$	11 4	$\frac{2}{3}$	0	
13	Tuberculosis of the Lungs	M	77 67		27	16 19	$^{6}_{14}$	62 76	$\frac{105}{225}$	595 1,112	$1,391 \\ 1,978$	$1,781 \\ 2,118$	$^{1,812}_{1,626}$	1,868 1,371	$1,799 \\ 1,078$	$^{1,843}_{866}$	1,574 $540$	$^{1,109}_{392}$	$\frac{771}{311}$	$\frac{576}{271}$	$\frac{321}{158}$	$^{135}_{68}$	$\begin{array}{c} 37 \\ 26 \end{array}$	$^{15}_{3}$	$\frac{2}{1}$	0 0		15,9 <b>9</b> 3 12,389
14	Tuberculous Meningitis	M F	190 147	174	113	59 75	54 46	$\frac{139}{140}$	72 81	51 81	35 63	43 36	35	25	19 10	20 7	5 <b>5</b>	4 5	2	1 1	0 1	0	. 0	0	0 0	0		1,0 <b>42</b> 991
15	Other forms of Tuber-	M F	175 120	85	42	25	25 13	80 58	$\frac{91}{61}$	$\frac{106}{111}$		$\frac{129}{125}$	93 109		99 70	93 <b>64</b>	86 47	81 24	47 35	$\frac{31}{19}$	$\frac{32}{13}$	16 5	1 4	$\frac{2}{2}$	0 1	0		1,565 $1,266$
16			20	20	22	14	16	53 20	$\frac{27}{33}$	61 46	87 73	138 160				$1,278 \\ 1,526$	$1,729 \\ 1,643$	$^{1,957}_{1,683}$	$^{2,117}_{1,658}$	$2,433 \\ 1,729$	$\frac{2,038}{1,549}$	$^{1,471}_{1,198}$	708 561	$\frac{276}{234}$	32 56			15,745 14,271
160	ant Tumours Other General Diseases*	1	975 702	153	102	104	79	381 350	331 305	375 289	449 372	372 425				753 504	801 569	$\frac{728}{579}$	688 559	$\frac{637}{651}$	478 500	$\frac{359}{413}$	$\frac{170}{143}$	48 37	5 5	1 4	C	9,647 8,111
17	Simple Meningitis*	M	1,096	600	251	122	87	308 229	175 134	205	203	142			87 57	$\frac{105}{70}$	86 49	$\begin{array}{c} 61 \\ 26 \end{array}$	40 16	$\frac{35}{20}$	$\frac{27}{18}$	$^{14}_{13}$	7	1 1	1 1	0	'	$3,850 \\ 2,816$
18		M	175 137	43	13	7	4	21 20	16 16	37	64	77				492 410	734 613		1,067 831	$^{1,225}_{1,152}$	$1,399 \\ 1,442$	$1,341 \\ 1,350$	809 807	$\frac{315}{363}$				9,481 8,613
186	and Softening*  Other Diseases of the	M	2,042 1.450	349	201	99	86	207 176	175	251	290	299		494 289	596 343	790 <b>351</b>	739 363	661 318	$\frac{619}{385}$	$\frac{699}{420}$	. 579 350	$\frac{524}{341}$	$\frac{252}{191}$	93 89				10,459 6,851
19		M	38	33	17	9	19	156	231	344	367	395	437	622	959	1,328 984	1,787 1,169	2,071 1,278	$^{2,432}_{1,585}$	$^{3,027}_{2,266}$	$^{3,266}_{2,490}$	$2,955 \\ 2,350$	1,711 1,259	$\frac{657}{532}$				23,043 17,500
19	Heart  7 Other Diseases of the Cir	-   M	106	26	   17	15	16	106	81	135	137	141	173	280	400	551 274	678 270	721 317	623 268	800 400	$\frac{780}{515}$	711 440	416 282				) 1 1 (	$\begin{array}{ccc} 1 & 7,139 \\ 2 & 4,492 \end{array}$
20	culatory System*  Acute Bronchitis*	M	1,273	197	74	36	19	31	7	7	11		6	† 5 12	9	20	29	26	40 32	56 48			87 86			2		$\begin{array}{ccc} 1 & 2,214 \\ 0 & 1,805 \end{array}$
21	Chronic Bronchitis .	F M F	954	i 8	3 1	. 0	3	20	!	7	!   14	15	18	27	44	101	139	198	363 183					406 340				1 4,761 5 3,618

22 Pneumonia*	MF	1,163 851	544 447			69 57	$\frac{234}{178}$	135 140	$\frac{257}{174}$	429 244	391 258	499 281	658 357	690 346	896 339	841 285	637 298	626 285	610 418				143 98			2	10,691 6,491
23 Other Diseases of the Respiratory System*	M F	1,899 1,461	721 607		133 137	104 85		76	109 93	159 1 <b>3</b> 3	180 118	176	299 165	433	532	598	588 205	592 249	698	707	701	461	206	35	8	1	9,894 6,296
24 Diseases of the Stomach*	M F	259 224	44 41		11 10	8 9	17 25	12 16	15 41	27 68	42 63	$\frac{49}{70}$	77 82	74 84	112 86	109 74	112 88	111 70	132	142	127	82	34	7	o	0	1,622
25 Diarrhœa and Enteritis (all ages)*	M F	12,462 9,889	$2,554 \\ 2,218$	439 422	$197 \\ 162$	89 90	171 191	48 44	43 41	44 65	62 68	66 77	92 104	89 93	$\frac{121}{127}$	$^{149}_{110}$	181 138	220 194	294 305	425 390	436		133	39	7 13	1 5	18,694 15,683
26 Appendicitis and Typhlitis	M F	4 2	2 5	97	$\frac{12}{10}$	$^{16}_{17}$	$\frac{137}{128}$	$\frac{208}{182}$	$\frac{234}{170}$	$\frac{254}{120}$	$\frac{161}{106}$	146 90	122 81	108 49	$^{119}_{72}$	87 56	67 30	47 23	33 27	28 21	10 7	5 4	0 2	o	0	0	1,809 1,209
27 Hernia, Intestinal Obstruction*	M F	456 2 <b>6</b> 6	67 24	$\frac{27}{18}$	16 9	11 11	$\frac{32}{37}$	$^{26}_{18}$	$^{48}_{15}$	43 28	43 49	58 62	58 88	78 79	111 115	$\frac{116}{101}$	$\frac{123}{111}$	$\frac{155}{120}$	163 169	188 171		95 83			1	1 0	2,135 1,795
28 Cirrhosis of Liver	M F	8	7 5	0 4	1	$_{0}^{1}$	8 8	7 5	7 5	$^{12}_{11}$	$\frac{34}{21}$	64 35	107 79	$\frac{196}{119}$	$\frac{285}{171}$	$\frac{362}{147}$	293 134	239 129	$\frac{210}{109}$	151 79	115 66	$rac{40}{24}$	8	0	0	0	2,155 1,163
28a Other Diseases of the Digestive System*	M F	$\frac{206}{172}$			38 43	$\begin{array}{c} 27 \\ 40 \end{array}$	$\frac{127}{159}$	75 91	$^{112}_{92}$	$\begin{array}{c} 117 \\ 162 \end{array}$	$\begin{array}{c} 150 \\ 208 \end{array}$	$\frac{139}{199}$	$\frac{180}{207}$	$\frac{217}{223}$	$\frac{237}{204}$	$\frac{272}{246}$	$\frac{235}{225}$	$\frac{218}{248}$	$\frac{263}{258}$	$\frac{228}{240}$	176 190	85 97			1	0	$3,228 \\ 3,415$
29 Acute Nephritis and Bright's Disease*	M F	127 80	57 59	$\frac{28}{27}$	$\frac{27}{11}$	$^{17}_{12}$	92 85	77 97	$\frac{196}{183}$	$\begin{array}{c} 297 \\ 354 \end{array}$	$\frac{324}{349}$	310 323	$\frac{437}{420}$	658 482	918 553	$^{1,055}_{639}$	$^{1,120}_{602}$	$^{1,136}_{617}$	$^{1,219}_{668}$	1,144 618	$^{1,013}_{455}$	$\frac{501}{240}$	171 78		97	0	10,964 6,981
30 Non-cancerous Tumoursof the Female Genital Organs	M F	0 4	0	0	0	0	0 1	0	0 19	$\begin{array}{c} 0 \\ 124 \end{array}$	$\begin{matrix} 0 \\ 168 \end{matrix}$	$\begin{array}{c} 0 \\ 184 \end{array}$	$\begin{array}{c} 0 \\ 158 \end{array}$	$\begin{array}{c} 0 \\ 157 \end{array}$	$\begin{array}{c} 0 \\ 152 \end{array}$	. 0 82	0 <b>5</b> 9	0 41	$\begin{array}{c} 0 \\ 32 \end{array}$	0 37	0 30	0	0 5	0 3	0	0	0 1,266
30a Other Diseases of the Genito-urinary System*	M F	45 22	10 6	1 3	1 1	3 3	10 8	4 4	10 9	$\frac{38}{25}$	$\frac{33}{32}$	40 34	$\begin{array}{c} 73 \\ 46 \end{array}$	109 51	$^{156}_{52}$	$^{179}_{58}$	$\frac{225}{57}$	347 56	$\frac{524}{51}$	685 68	811 55	538 30	$\frac{242}{15}$	40 2	7 0	0	$^{4,131}_{688}$
31 Puerperal Septicæmia	M F	0	0 0	0	0	0	0	0 1	0 96	$\begin{matrix} 0 \\ 370 \end{matrix}$	$\begin{array}{c} 0 \\ 514 \end{array}$	0 459	307	$\begin{array}{c} 0 \\ 112 \end{array}$	$\begin{smallmatrix}0\\12\end{smallmatrix}$	. 0	0 0	0 0	0	0	0	<b>0</b>	0 0	0	0	0	$\begin{smallmatrix}&&0\\1,872\end{smallmatrix}$
32 Other Accidents of Preg- nancy and Labour	M F	0	0 0	0	0	0 0	0 0	0 4	0 161	587	$\begin{array}{c} 0 \\ 816 \end{array}$	799	$^{0}_{829}$	$\begin{array}{c} 0 \\ 397 \end{array}$	0 55	0	0	0 0	0	0	0	0	0	0 0	0	. 0	$\begin{smallmatrix}&&0\\3,648\end{smallmatrix}$
32a Diseases of the Skin and Cellular Tissue*	M F	195 149	15 18	10 9	7 5	5 5	13 13	. 15 8	$^{17}_{16}$	19 15	29 25	$\frac{27}{24}$	$\frac{34}{25}$	$\frac{35}{27}$	$\frac{70}{32}$	56 35	$\frac{69}{43}$	74 60	$^{107}_{79}$	140 110	$\frac{163}{149}$	$\frac{132}{108}$			7 7	1 1	$^{1,343}_{1,022}$
32b Diseases of the Organs of Locomotion	M F	34 17	18 17		13 7	$^{13}_{6}$	56 27	$\frac{58}{20}$	26 5	17 10	$\frac{20}{10}$	11 7	18 8	$^{10}_{6}$	11 8	19 9	13 8	22 5	$^{15}_{9}$	$^{19}_{14}$	12 5	4 4	$\frac{2}{1}$	1 0	<b>1</b> 0	0	$\frac{426}{212}$
33 Congenital Debility and Malformations*	M F	17,204 12,976	109 85	43 23	$\frac{15}{14}$	$^{12}_{13}$	$\frac{21}{18}$	11 7	8 2	$\frac{2}{0}$	1 0	0	0	0 0	$_{0}^{1}$	0	0	0	0	0	0	0	0	0	0	0 0	$17,428 \\ 13,138$
33a Other Diseases of Infancy	M F	2,143 1,638	0	0	0	0	0	0	0	0 0	0	0	0 0	0	0	0	0	0	0	0	0	0	0	0	0	0 0	$^{2,143}_{1,638}$
34 Senile Debility	M F	0	0	0	0	0	0 0	0	0	0	0	0	0 1	2 0	<b>4</b> 2	$^{14}_{10}$	$rac{81}{21}$	$\frac{393}{213}$	$^{1,142}_{783}$	$^{3,104}_{2,096}$	$^{4,802}_{3,470}$	$^{5,057}_{3,917}$	$^{3,121}_{2,827}$		$\frac{278}{309}$	78 64	$^{19,192}_{14,861}$
35 Violent Death—Suicide Excepted*	F F	903 672	493 377	369 291	$\frac{248}{225}$	$\frac{177}{189}$	863 471	$\frac{902}{294}$	1,472 294	1,763 289	$^{1,661}_{251}$	1,495 224	1,446 235	$^{1,510}_{203}$	$^{1,597}_{204}$	$^{1,418}_{210}$	1,110 188	$\frac{869}{151}$	$705 \\ 225$	$\frac{622}{243}$	$\frac{429}{250}$	$\frac{288}{214}$	$^{120}_{128}$	24 59	$^{10}_{12}$	3 4	$20\ 497 \\ 5,903$
<b>36</b> Suicide	F F	0	0	0	0	0	0	13 8	76 79	$\frac{264}{116}$	$\frac{362}{113}$	$\frac{425}{122}$	$\begin{array}{c} 473 \\ 101 \end{array}$	523 90	$\frac{507}{105}$	$^{475}_{72}$	367 48	265 29	$\frac{203}{17}$	112 11	$^{64}_4$	$^{32}_{1}$	$^{13}_{0}$		0	0	$^{4,174}_{916}$
38 Unknown or ill-defined Diseases*	F M	672 612	$\frac{241}{251}$	52 42	33 23	16 18	61 37	42 26	49 28	69 59	84 70	$\frac{106}{72}$	170 99	$\frac{242}{115}$	$\frac{299}{163}$	$\frac{458}{185}$	$\frac{439}{154}$	502 209	$\frac{421}{177}$	$\frac{282}{113}$	$\frac{217}{94}$	108 47	$\frac{50}{28}$		$\frac{3}{2}$	$_{1}^{0}$	$^{4,622}_{2,626}$
Total Deaths*	M F	45,797 35,452	7,808 6,742	3,089 2,695	$1,914 \\ 1,742$	$\frac{1,376}{1,334}$	4,678 4,191	3,401 2,960	5,399 4,529	7,666 6,840	7,961 7,500	7,985 6,982	9,349 7,553	11,084 7,357	13,757 7,971	14,928 8,114	1 <b>4,447</b> 7,958	14,870 8,753	17,096 11,433	18,747 13,348	18,824 13,863	13,357 10,029	6,544 5,540	1,842 1,918	440 474		252,463 185,367
Frequency relative to total according to age-group	M F	18,140 19,125			758 940	545 720	1,853 2,261	<b>1,34</b> 7 <b>1,</b> 597	2,138 2,443	3-036 3,690	3,153 4,046	3,163 3,766	3,703 4,074	4,394 3,969	5,449 4,300	5,913 4,377	5,722 4,293	5,890 4,722	6,771 6,168	7,425 7,201		5,291 5,410			174 256		100,000 100,000
* Causes of d	leath	for whic	h the	mortal	ity is	relativ	ely gr	eat du	ring tl	ne fi <b>r</b> st	year (	of life.		† For	the rela	tive free	quency	of each	cause	of death	ı, see Ta	ble CL	I. pre	ferably	, or CI	r.	

TABLE CL.—Ratio according to Age-groups of Deaths from Particular Causes to the Total Deaths from all Causes in the same Age-group according to Sex. Average for 9 years. Australia, 1907-1915.

Ref No.	Cause.	Sex	0	1	2	3	4	to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89	90 to 94	95 to 99	100 and over.	All Ages.
1	Typhoid Fever	M F	0002 0001	0013 0009		0084 0103	0102 0127	0188 0200	0394 0686		0955 0509	0820 0351		0348 0177		$0142 \\ 0103$		0049 0043	0034 0017	0016 0014	0007 0010	0003 0001	$0002 \\ 0001$	0002 0005	::			$0140 \\ 0104$
.5	Measles	M F	0046 0048	0403 0356	$0473 \\ 0401$	$0293 \\ 0356$	$0247 \\ 0262$	$0214 \\ 0246$		0046 0066	$0078 \\ 0026$			$0008 \\ 0023$	0004 0015	$0006 \\ 0015$		0004 0006	$0001 \\ 0003$	$0002 \\ 0002$	$\begin{array}{c} 0002 \\ 0002 \end{array}$	$0001 \\ 0001$	0001	0002	::	::	::	$0041 \\ 0048$
7	Whooping Cough	M F	0246 0356	0460 0602		$0256 \\ 0373$	$0196 \\ 0232$	$0094 \\ 0146$	$\begin{array}{c} 0003 \\ 0010 \end{array}$	0002	0001	0001 0003	::	::	::			$\begin{array}{c} 0001 \\ 0003 \end{array}$	$0001 \\ 0001$	$0001 \\ 0001$	::	0002			::	::		0068 0108
:8	Diphtheria and Croup	M F	0040 0038	0487 0458	$1198 \\ 1254$	$\frac{2116}{1860}$	$\frac{2188}{2316}$		$\begin{array}{c} 0547 \\ 0706 \end{array}$	$\begin{array}{c} 0096 \\ 0155 \end{array}$	0026 0038	$0021 \\ 0027$	0013 0016		$\begin{array}{c} 0006 \\ 0011 \end{array}$	0002 0004	0006	$0004 \\ 0003$	$0001 \\ 0003$	0001 0001	::	$0001 \\ 0001$	::	0001	::	0021		0109 0148
9	Influenza	M F	0040 0036	0052 0061		0084 0069	0080 0038		$0050 \\ 0095$	$0082 \\ 0082$	$0068 \\ 0092$						0072 0099		$0078 \\ 0136$	$0100 \\ 0152$	$0122 \\ 0184$	$0129 \\ 0209$	$0133 \\ 0161$	$0122 \\ 0177$	0182	0136 0190	0225	0083 0105
12	Other Epidemic Diseases	M F	0029 0032	0037 0028		$0026 \\ 0052$	0051 0083	$0034 \\ 0029$	$0044 \\ 0044$	$0065 \\ 0049$	$0104 \\ 0041$	0114 0041		$0065 \\ 0017$		$0055 \\ 0054$		$0046 \\ 0024$	0050 0056	$0045 \\ 0051$	$0049 \\ 0042$	0038 0048				0046 0063	0096	0050 0040
13	Tuberculosis of the Lungs	M F	0017 0019		0087 0082	$0084 \\ 0109$		$0133 \\ 0181$	0309 0760		$\frac{1814}{2892}$		2269 2329		$1623 \\ 1465$	1340 1086			0355	$0337 \\ 0237$	$0171 \\ 0118$	0049	0028 0026	0023 0005	0011 0005	::		0634 0668
14	Tuberculous Meningitis	M F	0042 0042			$0308 \\ 0430$			$0212 \\ 0274$	$0094 \\ 0179$	$0046 \\ 0092$				$0017 \\ 0014$	0015 0009		0003 0006	0001	0001 0001	0001	0001			::			0041 0054 0062
15	Other Forms of Tuber- culosis	M F	0038 0034			$0131 \\ 0121$	0182 0098		$0268 \\ 0206$		$0157 \\ 0209$					0068 0080		0056 0030	0040	0017	0010	1	0001	1	0005		0.491	0068 0624
16	Cancer and other Malig- nant Tumours	M F	0004			$0073 \\ 0109$	0116 0075			$0113 \\ 0102$		$0173 \\ 0213$						2115	1894	į	1160	- 1		0422	0292	0232	0481	0770 0382
16a	Other General Diseases	M F	0213 0198								0586 0544					$0547 \\ 0632$		0504 0728	0639	0373 0569	0375	0298		0067	0027 0026	$0023 \\ 0084$		0438
17	Simple Meningitis	M F	0239 0253						$0515 \\ 0453$		0265 0146					0076 0088		0042 0033		0021 0017	0014	0007 0009	0005	0002	0005			0152
18	Cerebral Hæmorrhage and Softening	M F	0038				0029 0060		$0047 \\ 0054$		0083 0088				0289 0345			$0629 \\ 0815$		1008	1080		0805	0655	0386 <sub>i</sub> 0537	0359	0192 0112	0465
18a	Other Diseases of the Nervous System	M F	0446 0409			$0517 \\ 0522$					0378 0347			0528 0383			0495 0447	0458 0400	0440	0367	0262	0246	0190	0161	0054 0125			0370
19	Organic Diseases of the Heart	M F	0008 0010						0679 0976		0479 0509							1606	1811	1982	1865	1695	1255	1004 0960	0620	0401	0112	0944
19a	Other Diseases of the Circulatory System	M F	0023 0017						0238 0395							0401 0344			0306	0350	0386	0317	0281	0253	0177	0084	0096	0242
20	Acute Bronchitis	M F	0278 0269		0240 0223				$0021 \\ 0020$						0008 0020	0014 0016	0019			0042	0059	0084	0086	0070	0099	0042	ļ	0097
21	Chronic Bronchitis	M F	0002			0012	0022	00 <b>43</b> 00 <b>1</b> 9			0017	0032	0019	0036	0040 0033	0060	0109	0156	0209	0353	0498	0587	0650	0614		0759	0562	0195
22	Pneumonia	M F	0254 0 <b>24</b> 0					0500 0425		0476 0384	0560 0357	0491 0344	0625 0403	0704 0473	0623 0470	0651 0425	0563 0351	0441 0374	0421 0326	0357 0366	0325 0334	0291 0307	0243	0218 0177	0217 0193			0350

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23	Other Diseases of the Respiratory System	M F	$0415 \\ 0412$	0923 0900		0695 0786	0756 0637		$0223 \\ 0284$		0207 0194			$0320 \\ 0219$		$0387 \\ 0243$	$0401 \\ 0280$			$0408 \\ 0318$	0377 0350			$0315 \\ 0249$	$0190 \\ 0224$	$0182 \\ 0190$		$0392 \\ 0340$
24	Diseases of the Stomach	M F	0057 0063	$0056 \\ 0061$		$0057 \\ 0057$	0058 0068	0036 0060		0028 0090	0035 0099			$\frac{0082}{0109}$	$0067 \\ 0114$		$0073 \\ 0091$	$0078 \\ 0111$		0077 0095	$0076 \\ 0095$		$0061 \\ 0099$	$\frac{0052}{0070}$	0038 0057	0042		$\frac{0064}{0085}$
25	Diarrhoea and Enteritis (all ages)	M F	$\frac{2721}{2789}$	$\frac{3271}{3290}$	$1421 \\ 1566$	$\frac{1029}{0930}$	0647 0675	$0366 \\ 0456$		$0080 \\ 0091$	0057 0095	$0078 \\ 0091$	$\begin{array}{c} 0083 \\ 0110 \end{array}$	$\begin{array}{c} 0098 \\ 0138 \end{array}$	$0080 \\ 0126$	$0088 \\ 0159$	0100 0136	$0125 \\ 0173$	$0148 \\ 0222$	$0172 \\ 0267$	$0227 \\ 0292$	$0232 \\ 0304$	$0249 \\ 0328$	$0203 \\ 0256$	$0212 \\ 0235$	$0159 \\ 0274$	$0096 \\ 0562$	$\begin{array}{c} 0741 \\ 0846 \end{array}$
26	Appendicitis and Typhlitis	M F	0001 0001	0003 0007	$0029 \\ 0026$	$0063 \\ 0057$	$0116 \\ 0127$	$0293 \\ 0305$	$0612 \\ 0615$		$\begin{array}{c} 0331 \\ 0175 \end{array}$	$\begin{array}{c} 0202 \\ 0141 \end{array}$	$\begin{array}{c} 0183 \\ 0129 \end{array}$	$\begin{array}{c} \textbf{0131} \\ \textbf{0107} \end{array}$	$0097 \\ 0067$	0086 0090	$0058 \\ 0069$	$0046 \\ 0038$	$0032 \\ 0026$	$0019 \\ 0024$	$0015 \\ 0016$		$\begin{array}{c} 0004 \\ 0004 \end{array}$	0004		::		$0072 \\ 0065$
27	Hernia, Intestinal Obstruction	M F	0100 0075	$0086 \\ 0036$	$0087 \\ 0067$	$\frac{0084}{0052}$		0068 0088	$0076 \\ 0061$	$0089 \\ 0033$	$\begin{array}{c} 0056 \\ 0041 \end{array}$	$0054 \\ 0065$	$\frac{0073}{0089}$	$0062 \\ 0117$	$\begin{array}{c} 0070 \\ 0107 \end{array}$		$0078 \\ 0124$			$0095 \\ 0148$			$0071 \\ 0083$	$\frac{0050}{0085}$		0023	0096	$0085 \\ 0097$
28	Cirrhosis of Liver	M F	0002 0002	$\frac{0009}{0007}$	0015	0005 0006	0007	$0017 \\ 0019$	$0021 \\ 0017$	$0013 \\ 0011$	$0016 \\ 0016$	$0043 \\ 0028$	$0080 \\ 0050$		$\begin{array}{c} 0177 \\ 0162 \end{array}$		$0242 \\ 0181$		$\begin{array}{c} 0161 \\ 0147 \end{array}$	$0123 \\ 0095$	$0081 \\ 0059$	$0061 \\ 0048$	$0030 \\ 0024$	$0012 \\ 0005$				$0085 \\ 0063$
28 <i>a</i>	Other Diseases of the Digestive System	H F	0045 0049	0049 0043		$0199 \\ 0247$		$0271 \\ 0379$	$0221 \\ 0307$	$0207 \\ 0203$	$0153 \\ 0237$	$0188 \\ 0277$	$0174 \\ 0285$		$0196 \\ 0303$				$0147 \\ 0283$	$0154 \\ 0226$			0064 0097	0072 0076	$0027 \\ 0047$	$0023 \\ 0021$		$0128 \\ 0184$
29	Acute Nephritis and Bright's Disease	M F	0028 0023	0073 0088		$0141 \\ 0063$		$0197 \\ 0203$	$0226 \\ 0328$		$0387 \\ 0518$	$0407 \\ 0465$	0388 0463	$0467 \\ 0556$	$0594 \\ 0655$		0707 0787	0775 0757	0764 0705			0538 0328	$0375 \\ 0239$	$0261 \\ 0141$	$0168 \\ 0115$	$0205 \\ 0148$		$0434 \\ 0377$
.30	Non-cancerous Tumours of the Female Genital Organs	F	0001					0002	0003	0042	0181	0224	0264	0209	0213	0191	0101	0074	0047	0028	0028	0022	0009	0009	0016			0068
.30a	Other Diseases of the Gen- ito-urinary System	M F	0010 0006				$0022 \\ 0023$		$0012 \\ 0013$				0050 0049		.0098 0069		0120 0071			$0306 \\ 0045$			$0403 \\ 0030$	$0370 \\ 0027$	$0217 \\ 0010$	0159	::	0164 0037
31	Puerperal Septicæmia	F		••					0003	0212	0541	0685	0657	0407	0152	0015	0001	• •					••			••	••	0101
32	Other Accidents of Preg- nancy and Labour	F							0014	0355	0858	1088	1144	1098	0540	0069												0197
32a	Diseases of the Skin and Cellular Tissue	M F	0043 0042				0036 0038		0044 0027		$0025 \\ 0022$	0036 0033		$0036 \\ 0033$		0051 0040					$0075 \\ 0082$	0087 0108	$0099 \\ 0108$	$0121 \\ 0083$	0130 0068	0159 0148	$0096 \\ 0112$	
32b	Diseases of the Organs of Locomotion	M F	0007 0005						0170 0068		$0022 \\ 0015$			$0019 \\ 0011$							0010 0010		0003 0004		0005	0023	::	0017 0011
33	Congenital Debility and Malformations	M F	3757 3660		0139 0085		0087 0098	$0045 \\ 0043$	$0032 \\ 0024$		0003	0001	0001	::	::	0001	::	::	::	::	::		::	::	::	::		0690 0709
33a	Other Diseases of Infancy	M F	0468 0462	::		::			. ::				::	::	::	::	::	::	::	::	::		::	::	::		::	0085 0088
34	Senile Debility	M F				::	::		::	::			::	0001	0002	0003 0003			$0264 \\ 0243$				3786 3906			6318 6519		
35	Violent Death (Suicide excepted)	M F	0197 0190	0631 0559				$1845 \\ 1124$	$\frac{2652}{0993}$		$\frac{2300}{0423}$		$1872 \\ 0321$		$\frac{1362}{0276}$		0950 0259						$0216 \\ 0213$			$0227 \\ 0253$	0288 0449	
<b>3</b> 6	Suicides	M F	::		::		::		0038 0027	$0141 \\ 0174$	$0344 \\ 0170$	$0455 \\ 0151$	$0532 \\ 0175$		$0472 \\ 0122$	0369 0132	0318 0089						$0024 \\ 0001$	0020				0165 0049
<b>3</b> 8	Unknown or Ill-defined Diseases	M F	0147 0173	$0309 \\ 0372$	$0168 \\ 0156$	$0172 \\ 0132$	$0116 \\ 0135$	0130 0088	0124 0088		0090 0086		$0133 \\ 0103$		$0218 \\ 0156 \\$		0307 0228		0338 0239	$0246 \\ 0155$			0081 0047	0076 0051	0033 0005			0183 0142
	Total Total Deaths	M F	1.000 1.000				1.000 1.000			1.000 1.000									1.000 1.000									
	<del></del>																											

																			, wv	u	, <b>v</b> .				, J Cust .		. (2001-2	010).	
	Cause.	Sex	0	1	2	3	4	5-9	10–14	15–19	20–24	25-29	30–34	35-39	40–44	45-49	50-54	<b>5</b> 5–59	60-64	65-69	70–74	75–79	80–84	85–89	90-94	95–99	100 and over	All Ages	Relative Frequency of Death from each cause.*
1	Typhoid Fever	M F	. 15 . 10	$\frac{20}{12}$	17 30	34 39	31 38	41 40	$\begin{array}{c} 68 \\ 105 \end{array}$	$\frac{185}{169}$	348 174		266 114	$\frac{231}{104}$	180 86	160 82	$^{129}_{75}$	106 63	$\frac{107}{37}$	77 49	48 54	35 7	38 15	41 118	0	0	. 0	167 98	.01398 .01040
5	Measles	M F	390 331	629 <b>49</b> 5	$\frac{303}{231}$	120 136	7 <b>4</b> 78	47 50	$^{10}_{12}$	$^{12}_{15}$	29 9	10 11	10 11	5 13	3 10	$\begin{array}{c} 7 \\ 12 \end{array}$	11 8	9	$\frac{2}{7}$	8 6	$\frac{11}{12}$	6 7	25 39	0 0	0	0	0		.00414 .00479
7	Whooping Cough	M F	2,102 2,445	717 837	$\frac{210}{335}$	$\begin{array}{c} 108 \\ 143 \end{array}$	59 69	$\frac{21}{29}$	$\frac{1}{2}$	0 1	0 1	1 1	0 0	0	0	0	0	1 4	$\frac{2}{2}$	3 3	0	17 0	0	0	0	0	0	81 101	.00679
8	Diphtheria and Croup	M F	341 259	758 637	768 722	866 711	658 694	$\frac{373}{464}$	$\begin{array}{c} 94 \\ 108 \end{array}$	$\frac{25}{34}$		9 11	6 7	6 9	5	2 3	4 7	7 4	4 7	3 3	0	$^{12}_{7}$	0	<b>41</b> 0	0	0 808	0	130 140	.01087 .01482
9	Influenza	M F	$\frac{341}{250}$	82 85	35 38	34 26	24 11	$\begin{array}{c} \bf 16 \\ \bf 21 \end{array}$	$\begin{array}{c} 9 \\ 15 \end{array}$	$\begin{array}{c} 21 \\ 18 \end{array}$	$\frac{25}{31}$	33 28	$\frac{27}{31}$	56 54	71 46	101 68	109 103	$170 \\ 122$	248 296	$\frac{468}{528}$	848 1,018	$^{1,407}_{1,917}$	$2,240 \\ 2,340$	3,274 3,839	6,038 5,285	5,333 7,276	$\frac{0}{24,096}$	99 99	.00829
12	Other Epidemic Diseases	M F	$\frac{252}{221}$	58 39	$\frac{23}{34}$	$\frac{11}{20}$	15 25	7 6	8	17 11	$\frac{38}{14}$	49 19	$\frac{36}{22}$	43 10		62 43	84 60	100 35	$160 \\ 122$		342 232	417 436	655 552	1 <b>,146</b> 7 <b>44</b>	1,845 604		10,870		.00495
13	Tuberculosis of the Lungs	M F	144 130	$^{142}_{97}$	56 47	34 42	$\frac{13}{31}$	29 37	$\frac{53}{116}$	$\frac{282}{543}$	661 986	964 1,219	1,152 1,106	1,331 1,064	1,364 939	1,501 863	1,593 698	1,653 726	$^{1,646}_{774}$		$1,194 \\ 654$	782 449	466 378	$\frac{614}{117}$		0	0	757	.06334
14	Tuberculous Meningitis	M F	354 285	$\frac{348}{319}$	$\frac{235}{211}$	$\frac{126}{164}$	$\frac{118}{103}$	66 68	36 42	$\frac{24}{40}$	$\begin{array}{c} 17 \\ 31 \end{array}$	$\frac{23}{21}$	$\frac{22}{17}$	18 10	14 9	16 7	5 6	6	4 2	3 3	0	6	0	0 0	0	0	0	49	.00413
15	Other Forms of Tuber- culosis	M F	326 232	170 161	87 79	53 46	55 29	38 28	46 32	50 54	57 71	$\begin{array}{c} 70 \\ 72 \end{array}$	59 74	76 82	75 61	76 64	87 61	$121 \\ 44$	100 87	85 58	119 54	93 33	13 58	82 78	0 151	0	0	74	.00620
16	Cancer and other Malignant Tumours	M F	37 23	40 47	46 36	30 42	35 22	$\frac{25}{10}$	$^{14}_{17}$	29 22	41 36	$\frac{75}{92}$	$\frac{113}{211}$	253 483	526 938	1,041 1,521	$^{1,750}_{2,125}$	$2,917 \\ 3,116$	$^{4,519}_{4,124}$	6,658 5,249	7,580 6,409	8,518 $7,917$	8,913 8,153	$^{11,296}_{9,166}$		14,222 8,892	54,347 0	744	.06236
16a	Other General Diseases	M F	1,818 1,359	306 293	$\frac{210}{205}$	$\frac{222}{169}$	$\frac{173}{130}$	180 168	$\frac{168}{157}$	$\frac{178}{141}$	$\frac{213}{185}$	201 245	285 289	385 369	507 375	$\frac{613}{502}$	811 736	1,085 1,071	1,469 1,391	1,743	1,779 2,069	2,079 2,729	2,140 2,078	1,965 1,449		889 3,234	0		.03821 .04376
17	Simple Meningitis	M F	$\frac{2,044}{1,738}$	1,198 958	521 380	261 268	190 184	$\frac{146}{111}$	89 69	98 66	96 50	$\frac{77}{41}$	59 40	74 55	66 50	86 70	87 63	90 48	85 40		100 74	81 86	88	41 39	168 151	0	0		.01525 .01519
18	Cerebral Hæmorrhage and Softening	M F	326 265	86 93	$\frac{27}{21}$	$\frac{15}{20}$	9 18	10 10	8 8	18 16	30 30	42 38	86 55	$\frac{136}{107}$	$\frac{243}{221}$	401 409	743 793	$^{1,353}_{1,201}$	$^{2,278}_{2,067}$	3,352 3,497	5,203 5,967	7,765 8,922	10,184 $11,728$	$12,892 \\ 14,219$	11,909 15,551		21,739 $12,048$	448	.03755
18a	Other Diseases of the Nervous System	M F	3,808 2,807	697 727	417 369	$\frac{212}{200}$	188 186	98 85	89 79	119 95	138 118	$\frac{162}{138}$	$\frac{256}{158}$	$\frac{352}{224}$	452 299	643 350	$\frac{748}{469}$	985 589	1,321 958	1,913	2.153	$3,034 \\ 2,254$	3,172 2,776			889 3,234	10,870 12,048	495	.04143
19	Organic Diseases of the Heart	M F	71 71	66 47	35 43	19 46	40 47	74 84	$\begin{array}{c} 117 \\ 149 \end{array}$	$\frac{163}{169}$	$\frac{174}{173}$	$\frac{214}{232}$	278 295	443 449	727 657	1,081 981	1,808 1,512	3,087 2,366	$5,191 \\ 3,943$	8,283 6,879	$12,147 \\ 10,303$	$17,111 \\ 15,530$	$21,540 \\ 18,296$	26,890 20,839	24,488 17,967	27,556 15,360	54,348 12,048	1,089	.09126
19a	Other Diseases of the Circulatory System	M F	198 118	52 58	35 30	32 33	35 44	50 38	41 60	64 65	65 <sub> </sub> 93	$\frac{76}{113}$	$\frac{110}{144}$	199 168	303 236	$\frac{449}{273}$	686 349	1,075 587	1,330 667	2,189	$^{2,900}_{2,131}$	$^{4,117}_{2,908}$	5,237 4,098	7,285 5,484	6,206 5,134		10,870	338	
20	Acute Bronchitis	M F	$2,374 \\ 1,846$	393 348	$\frac{154}{128}$	$\frac{77}{72}$	40 35	15 16	4 3	3 4	5 2	5 7	4 6	9 6	7 13	16 13	29 21	39 48	85 80		338 327	724 773	1.095	$^{1,678}_{1,528}$	1,174 2,869	0	10,870 0	105	.00877
21	Chronic Bronchitis	M F	9 15	6	$^2_{\bf 4}$	0	7	9	5 5	3 5	7 6	8 14	11 9	19 21	33 20	82 48	$\frac{141}{114}$	295 230	775 455	$1,521 \\ 1,226$	3,027 2,747	6,028 5,379	10,575 9,475		18,450 17,364	$23,111 \\ 29,102$	10,870 60,241	225 184	.01886
22	Pneumonia	M F	$2,169 \\ 1,647$	1,086 921	490 359	$\frac{233}{197}$	$\frac{151}{128}$	111 86	69 72		$\frac{204}{122}$	$\frac{212}{148}$	$\frac{317}{191}$	469 277	$\frac{523}{311}$	730 338	851 369	949 552		1,669	2,265	3,173	4,079		6,709 5,585		21,739 0		.04235

TABLE CLI.—Death-rates in Age-groups or the Number of Deaths in Australia per Million Persons in each Age-group, according to Cause, Age and Sex. 9-year Average. (1907-1915).

421	

23	Other Diseases of the Respiratory System	M F	3,541 2,828	1,440 1,251	571 514		228 191	96 86	39 43		76 66	97 68	112 78	213 128	328 129	433 193	605 294	876 380		1,910 1,105		4,059 3,212	5,804 5,014	8,431 5,406	5,871 6,493	7,111 7,276		468  .03919 321  .03397
24	Diseases of the Stomach	M F	483 434	88 84			17 20	8 12	. 6	7 20	13 34	23 36	31 48	55 63	56	91	110	167	237	361	528	735	1,032	1	1,174	, ,	o	77 .00642 81 .00853
25	Diarrhœa and Enteritis (all ages)	M F	23,238 19,140	5,101 4,570	912 901	421 355	$\frac{195}{202}$	81	$\frac{24}{23}$	20	21	34 39	42 53	66 81	68	99	151	270	470	805		2,525			6,541	6,222	10.870	884 .07405 799 .08461
26	Appendicitis and Typhlitis	M F	7 4	4 10	19 15		35 38	65 62	106 94		120 60	87 61	93 61	87 63	82	97		1	100	90	104		63	o	0	0 0	00,241	86 .00717 62 .00652
27	Hernia, Intestinal Obstruction	M F	850 515	134 49			$\frac{24}{24}$		13 9	23 7	20 14	$\frac{23}{28}$	37 42	41 68		90	117	183 205	331 299		699 708	1,042	1,196	1,351	1,006	889	10,870	101 .00846 91 .00968
28	Cirrhosis of Liver	M F	15 15	14 10	0	$\frac{2}{2}$	$\frac{2}{0}$	4	4 3	$\frac{3}{2}$	6 5	18 12	41 24	76 61		232 170	366 190	437 248	510 321		562 327	666 436	504	327 118	0	0	0	102 .00854 59 .00627
28 <i>a</i>	Other Diseases of the Digestive System	M F	384 333	76 60	73 64		59 90		38 47	53 45	56 80	$\frac{81}{120}$	88 135	$\frac{128}{161}$	169 194	193 203	275 318	350 417	465 617	720 783	848 993	1,019 1,256	1,070	$1,924 \\ 1,645$	839 1,359	889 808	0	153 .01279 164 .01842
29	Acute Nephritis and Bright's Disease	M F	237 155	$\frac{114}{122}$		$\frac{58}{24}$	$\frac{37}{26}$	44 41	39 50	93 89	$\frac{141}{176}$	$\begin{array}{c} 175 \\ 201 \end{array}$	$\frac{197}{220}$	311 326		747 551	1,068 827	$1,669 \\ 1,114$	$2,425 \\ 1,535$	3,336 2,028	4,255 2,557	5,866 3,007	6,307	6,999 3,055	5,200	8,000	0	518 .04343 356 .03766
<b>3</b> 0	Non-cancerous Tumors of the Female Genital Organs	F.	8	0	0	0	0	1	1	9	62	97	125	123	136	151	106	109			153	198	131	196	453	0	0	65 .00683
30a	Other Diseases of the Genito-urinary System	M F	84 43	$\frac{20}{12}$		$\frac{2}{2}$	7 7	5 4	$_{2}^{2}$	5 4	18 12	18 18	25 23	$\frac{52}{36}$	83 44	$^{127}_{52}$	181 75	$\frac{335}{106}$	741 139	1,434 155	2,548 281	4,696 363	6,773 436	9,905 588	6,709 302	6,222 0	0	195 .01636 35 .00371
31	Puerperal Septicæmia	F	О	0	0	0	o	0	1	47	184	296	312	238	98	12	1	0	0	0	0	0	o	0	0	o	0	95 .01010
<b>3</b> 2	Other Accidents of Pregnancy and Labour	F	o	0	0	0	0	0	2	79	292	469	544	643	346	55	0	0	0	0	o	0	o	0	0	0	0	186 .01968
32a	Diseases of the Skin and Cellular Tissue	M F	364 288	30 37	21 19	15 11	11 11	6 6	8 4	8 8	9	16 14	17 16	$\frac{24}{19}$	$\frac{27}{24}$	$\frac{57}{32}$	57 45	103 80		293 240	521 455	944 985	1,661 1,569	$3,233 \\ 1,802$	4,026 1,963	6,222 5,659	10,870 12,048	64 .00532 52 .00551
32 <b>b</b>	Diseases of the Organs of Locomotion	M F	63 . 33	36 35	27 19	28 15	$\frac{28}{13}$		$\frac{29}{10}$	$^{12}_{2}$	8	11 6	7 5	13 6	8 5	9	$^{19}_{12}$	19 15		$rac{41}{27}$	71 58	69 33	50	82 39	168 0	'	0	20 .00169 11 .00114
33	Congenital Debility and Malformations	M F	32,080 25,116	$\frac{218}{175}$	89 49		$\frac{26}{29}$		6 <b>4</b>	4 1	1	1	1 0	0	0 0	1 0	0	0	0	0	. 0	0	0	0	0	0	C	824 .06903 670 .07088
33a	Other Diseases of Infancy	M F	3,996 3,170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	101 .00849 83 .00884
34	Senile Debility	M F	0	0	0	0	0	0	0	0	0	. 0	0	$_{1}^{0}$	2 0	3 2	14 13			3,125 2,377	$^{11,544}_{8,673}$	27,807 $22,932$	63,663 56,924	127,737 $110,737$	187,186 $173,335$	$247,111 \\ 249,798$	847,825 771,085	907 .07602 757 .08017
35	Violent Death—Suicide excepted	M F	1,684 1,300	984 777	767 621	531 493	$\frac{387}{425}$	409 227	$\frac{458}{152}$	$\frac{699}{144}$	838 144	899 144	951 153	1,030 183	$1,145 \\ 174$	$^{1,300}_{203}$	$^{1,435}_{272}$	$^{1,654}_{348}$			2,313 1,005	2,484 $1,652$	3,626	4,912 5,014	4,026	8,889	32,608 48,193	969 .08119 301 .03184
36	Suicide	M F	0	0	0	0	0	0	7 4	36 39	125 58	196 65	270 83	337 78	397 78	$\frac{413}{105}$	481 93	547 89	566 72		417 46	371 26	403 14	532 0	0	0	0	197 .01653 47 .00494
38	Unknown or Ill-defined Diseases	M F	1,253 1,1 <del>8</del> 5	481 517	108 90	71 51	35 41		$\frac{21}{13}$	$\frac{23}{14}$	33 29	45 40	67 49	$\frac{121}{77}$	$\frac{184}{100}$	$\frac{243}{162}$	464 239	654 285	$^{1,072}_{520}$	1,152 537	1,049 468	1,257 621	1,360 683	$\frac{2,046}{1,097}$	$^{1,006}_{151}$	2,667 1,617	12,048	219 .01831 134 .01417
Deaths all Causes.	As at 30th June, 1911 Per 1,000,000 same sex and age-group.	M F	85,398 68,619	15,594 13,891	6,415 5,752	4,092 3,820	3,010 2,999	2,215 2,023	1,729 1,528	2,564 2,211	3,643 3,405	4,308 4,315	5,076 4,751	6,659 5,860	8,406 6,413	11,202 <b>7,</b> 944	15,107 10,495	21,533 14,733	31,741 21,773	46,782 34,707	69,723 55,231	109,003 91,615	168,152 145,747	267,834 217,008	308,957 289,596	391,111 383,185		1,937 1.00
Census Results	As at 31st Dec., 1905†	M F	101,120 83,490	18,040 16,840	6,770 6,310	4,410 4,120	0,200	2,004	1,703	2,004	5,097	1,080	5,602 6	5,597	7,569	8,586	10,681	21,057 15,038	30,674 23,324	47,596 36,575	76,464 60,289	116,621 94,307	169,497 138,276	247,539 208,288	360,968 31 <b>2,1</b> 04	518,718 460,610	847,297 806,338	
							* Ca	lculate	d from	n the a	actual	aggree	rates g	iven i	n Tab	de CXI	JX.	† F	rom the	e Censu	s Life T	ables.						

TABLE CLII.—Shewing the Numbers Dying per Month during each of the First Four Weeks of Life per 100,000 of the same Sex and Age, and during each of the First 12 Months of Life per 1,000,000 of the same Sex and Age. Australia, 1910-1915,

		A	GE AT	DEATH.							AGE A	T DEA	ГН.					TOTAL
No.	MALES-CAUSE.	Under 1 week.	1 week and under 2 weeks	2 weeks and under 3 weeks	3 weeks and under 1 mth.	Under 1 Mth.	and under 2	and	and under 4	4 mths. and under 5 mths.	5 mths. and under 6 mths.	$rac{ ext{and}}{ ext{under}}$	7 mths. and under 8 mths.	8 mths: and under 9 mths.	9 mths. and under 10 mths.	11		Under 1 Year.
8 28 28 29 30 31 34 35 37 61 71 89 91 992 104 105 1551 1552 153	Whooping Cough Pulmonary Tuberculosis Acute Miliary Tubercular Meningitis Abdominal Tuberculosis Thebreulosis of Other Organs Disseminated Tuberculosis Syphilis Meningitis Convulsions Acute Bronchitis Broncho-Pneumonia Pneumonia Diarrheaa and Enteritis Hernia, Intestinal Obstruction Malformations Congenital Deblity, Icterus and Sclerema Other Diseases peculiar to early infancy Lack of Care Other Causes	776 7,193 1,713 29 480	3  .1 17 187 645 455 377 151 117 195 990 184 2 232	13 0 0 27 12 80 55 40 29 186 8 91 649 79 0 192 1,461	21 1 0 24 10 40 62 41 172 8 52 355 24 2 109 952	108	304 5 0 5 10 5 117 203 542 466 276 36 354 2,046 99 21 7,281	254 8 31 10 3 3 173 141 160 250 335 165 2,324 37 220 1,122 52 10 464	205 8 5 24 32 0 111 744 169 240 169 240 169 240 169 240 169 25,505 63 179 724 0 424 5,171	148 8 0 18 21 3 3 48 167 98 148 198 172 2,427 74 106 511 0 0 384 4,534	117 16 5 21 18 3 0 48 149 88 74 186 12,331 101 74 430 0 322 4,100		123 11 8 24 11 0 3 19 190 86 77 174 130 1,843 86 94 227 0 241 3,347	78 16 0 0 35 11 8 3 3 0 206 75 67 212 145 1,663 43 185 0 354 3,193	65 5 3 35 11 13 5 0 196 107 48 161 1,423 62 43 124 0 0 358	1 '	73 5 0 38 32 3 13 197 76 49 235 97 1,157 249 130 0 0 340 2,519	
	Population of males at the be- ginning of each period allow- ing for mIgration (on which the results are based). Total Deaths (Males) on which					385,413	6 989 881								••	371,409 901	370,753 93 <b>3</b>	370,087 88
	results are based	688,6	1,924	1,306	1,311		2,796	2,200	1,963	1,713	1,543	1,499	1,251	1,190	1,049	6		31,288
			AGE AT	DEAT	н,						AGE .	AT DEA	тн.					Тота
No.	FEMALES—CAUSE.	Under 1 week	and under	under	and r under 1	Under 1 Mth.	mth. and under 2 mths.	2 mths. and under 3 mths.	and unde:	and r under 5	5 mths. and under 6 mths.	7	and unde 8	and unde	and unde 10		and under 12	Year.
8 28 29 30 31 34 4 35 761 71 89 91 150 151 152 153	Whooping Cough Pulmonary Tuberculosis Acute Miliary Tubercular Meningitis Abdominal Tuberculosis Tuberculosis of Other Organi Disseminated Tuberculosis Syphilis Meningitis Convulsions Acute Bronchitis Broncho-Pneumonia Pneumonia Diarrhoea and Enteritis Hernia, Intestinal Obstructic Malformations Congenital Debility, Icteru and Sclerema Other Diseases peculiar t early infancy Lack of Care Other Causes	2280 280 280 11 21 21 30 10 59 18 55,57 0 1,32	0  2 15 5 16 6 4 4 22 4 22 7 7 12 9 80 9 14 0 15 16 16 16 16 16 16 16 16 16 16	2 20 143 43 3 43 3 43 3 35 3 35 3 2 2 26 6 100 9 518 7 6 0 0 2 130	0 1 1 1 1 1 1 4 7 3 3 2 3 3 1 7 7 3 3 3 3 1 7 7 3 3 3 3 2 3 4 0 0 5 8 2 8 4 2 4 0 0 5 5 8	176 222 1,151 379 283 228 99 2,003 17,374 1,670	1,432 32 203 5 1,418	117 250 277 106 1,876 11 128 878 388 343	128 87 158 191 137 6 2,144 27 104 6 710 6 (6 6 (3 355	8 3 22 25 0 0 57 14 0 8 2 132 153 1188 2,197 57 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	$egin{array}{c c} 140 & 93 \\ 93 & 80 \\ 154 \\ 146 \\ 1,937 \\ 92 \\ \hline 0 & 352 \\ \hline 0 & 0 \\ 3 & 223 \\ \hline \end{array}$	135 94 72 163 149 1,666 77 80 2 265 0 0 0 0 0 3 254	122 136 1,544 53 47 243 253 3 2,90	8 00 25 177 0 0 150 6 6 6 6 6 163 103 134 1,322 4 1,323 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2 2 2 2	11 3 3 3 8 8 0 0 1172 1082 1083 1384 1384 1384 1386 6 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 1093 10	0 0 0 4 422 25 153 8 700 156 1 56 1 56 1 56 1 56 1 56 1 56 1 5	8 8 8 39 9 3 0 0 17 137 67 67 67 67 67 67 67 67 67 67 67 67 67	1,65 18,45 53 2,97 22,22 3,86 5,26
	Population of females at the beginning of each period allow	-27	373,570	372,209	371,276	370,516		368,534	366,933	365,413	364,077	362,943	361,949	361,078	360,333	359,557	358,927	358,426

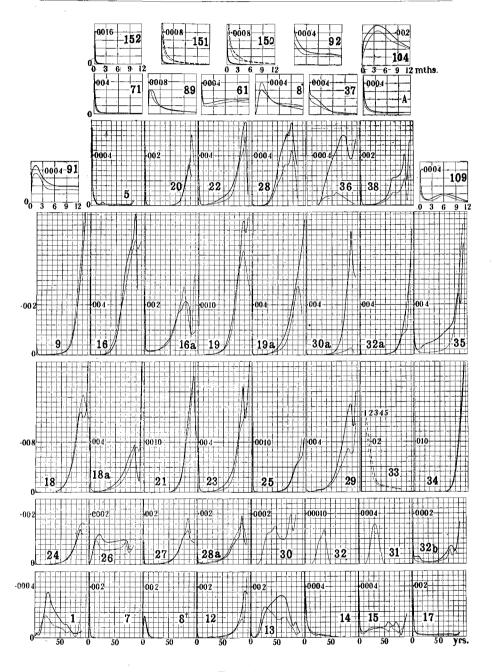


Fig. 104.

The 13 figures ruled into rectangles are death-rates for the first 12 months of life, the rates being shewn by the figures on one of the horizontal lines. The 38 figures ruled into smaller squares shew the death-rates for all ages of the diseases indicated by the numbers. For the index to the above curves see next page.

#### Index to Curves in Figure 104.

DEATH-RATES FOR ALL AGES.

- Typhoid Fever
   Measles.
   Whooping Cough.
   Diphtheria and Croup.
   Influenza.
   Other Epidemic Diseases.
   Tuberculosis of the Lungs.
   Tuberculosis of the Lungs.
   Tuberculosis of the Lungs.
   Other forms of Tuberculosis.
   Other forms of Tuberculosis.
   Gancer and other Malignant Tumours.
   Other General Diseases.
   Simple Meningitis.
   Cerebral Hæmorrhage and Softening.
   Other Diseases of the Nervous System.
   Organic Diseases of the Heart.
- ATH-RATES FOR ALL AGES

  19a. Other Diseases of the
  Circulatory System.

  20. Acute Bronchitis.

  21. Chronic Bronchitis.

  22. Pneumonia.

  23. Other Diseases of the
  Respiratory System.

  24. Diseases of the Stomach.

  25. Diarrhœa and Enteritis
  (all ages).

  26. Appendicitis and Typhlitis.

  27. Hernia, Intestinal Obstruction. 27. Herma, Anomotion.
  28. Cirrhosis of Liver.
  28a. Other Diseases
  Digestive System.
  29. Acute Nephritis
  Bright's Disease.
- Non-cancerous Tumours of Fernale Genital Organs.
   Other Diseases of the Genito-urinary System.
   Puerperal Septicæmia.
   Other Accidents of Pregnancy and Labour.
   Diseases of the Skin and Cellular Tissue.
   Diseases of the Organs of Locomotion.
   Congenital Debility and Malformations.
   Senile Debility.
   Violent Death (Suicide excepted).
   Suicide.
   Unknown or Ill-defined Diseases.

#### DEATH-RATES FOR FIRST YEAR OF LIFE.

™8.	w nooping Cough,
	Syphilis.
	Meningitis.
71	Contulgions

- 89. Acute Bronchitis,
- 91. Broncho-Pneumonia, 92. Pneumonia, 104. Diarrhoea and Enteritis. 109. Hernja and Intestinal Ob-struction.
- Malformations.
  Congenital Debility.
  Other Diseases peculiar to
  Early Infancy;
  Other Causes. 150. 151. 152.
- \* These numbers, on Fig. 104, are identical with those of the "Detailed Nomenclatures

of Diseases" of the International Commission, Session July 1909, at Paris.

† These numbers, on Fig. 104, are identical with those in Table CXLIX. to CLI., and where not marked "a" are those of the "Abridged Nomenclature" of diseases of 1909, where "a" or "b" added it denotes that the balance for the class in question is included.

The form of the mortality curves during the first year are given on the upper part of Fig. 104; see the Index thereto.

32. Annual fluctuation of death-rates.—The frequency of death from particular causes, and therefore generally, is affected by the season of the year, and though in the aggregate of deaths from all causes the seasonal effect is somewhat masked, it is not wholly obliterated. To ascertain rigorously the character of the annual periodicity, either generally or from a particular "cause," of death it is necessary to obtain the rates for small units of time, say equalised months; thus the rates  $\delta_1$ ,  $\delta_2$ , . . . .  $\delta_{12}$  must be obtained: these are sensibly independent of the fluctuations in the deaths and population during the month. Inasmuch, however, as deaths occur very rapidly in the first few days of life, any periodicity in birth-rate involves the death-rate; that is to say, the constitution of the population is not quite homogeneous, and a correction is—theoretically-necessary. The correction, however, is so small that it may be neglected. These last observations apply, mutatis mutandis, also to deaths from certain particular causes. The annual fluctuations of birthrate, and the mode of solving have been indicated at length in Part XI., §§ 14-19, pp. 166-174. General factors for reducing the values given for calendar months to the values for equalised months must be so applied as to have regard to the average values at the beginning and end of the

Table CLIII. depends upon a total of 252,443 deaths of males 1, and 185,367 deaths of females occurring in an aggregate population of

<sup>1</sup> For example there were 3529 deaths from typhoid in the 9 years, of which 473 occurred in the month of January. These, when corrected, for the growth of population during the year, and altered so as to give the result for the exact twelfth of the mean length of the year, gave the basis for the calculation of the results in the table.

over 21,000,000 males and nearly 20,000,000 females. The numbers given in the table correspond to a population of 10 millions in each case.

In Table CLIV. the proportions of deaths occurring in months of equal length, when the population is constantly the same, are given.

Algebraically if b and e be the equalising corrections at the beginning and end of the month to D, the number of deaths, and P be the sum of the populations of the corresponding month for the whole period under review, the results in Tables CLIII. and CLIV. are respectively:—

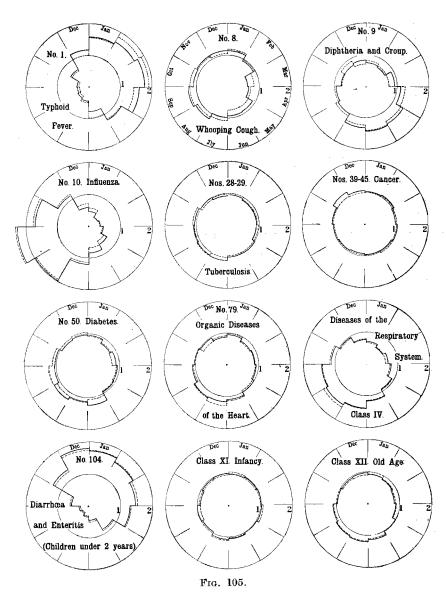
(650)..... $\delta = (D+b+e)/P$ ; (651).... $\rho = 12\delta / \Sigma \delta$ .

TABLE CLIII.—Shewing Average Number of Deaths due to Various Causes, per 10,000,000 Males, and per 10,000,000 Females respectively of all Ages during each Equalised Month of the Year. Based upon 9 Years' Experience (1907-1915) in Australia.

CAUSE OF DEATH.	s	ex Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Typhoid Fever		M 221 F 129	231 152			167						92		
Whooping Cough	l i	4 77	64 83	43	45	97 61	80 63	66	79	85		77	77	811
Diphtheria and Croup	[ ī	$egin{array}{c c} F & 100 \\ A & 81 \\ F & 95 \\ \hline \end{array}$	76 88	71 99 86	63 123	$\frac{64}{149}$			109	102		83	89	1,291
In fluenza	i	1 39 1 48	27 27	29 28	147 38 36	151 54	165 69	99	163	188	140	93	49	1,401 988
Tuberculosis	أ	613	581 484	585 489	580 514	$\begin{array}{c} 45 \\ 646 \\ 511 \end{array}$	56 641	94 713		692	146 669	640	590	
Cancer	į	637	659 628	604 613	638 615	603	512 594	533 571	595	619		622	658	7,443
Diabetes	1	£ 58	56 74	62 68	65 80	623 66 82	593 86 94	$578 \\ 78 \\ 102$			610	65	68	835
Organic Diseases of the Heart	N	I 855	784 613	802 650	832 667	903 697	995 834	1,052 950	1,070		99 925	90 884	794	
Diseases of the Respirator System		[ 757	$646 \\ 472$	743 471	844 581	$1,000 \\ 723$	1,250 $895$	1,500	891 1,594	780 1,519	744 1,197	629 1,042	830	12,922
Diarrhoea and Enteritis	$\left  \begin{array}{c} \tilde{\mathbf{M}} \\ \tilde{\mathbf{F}} \end{array} \right $	[ 1,021	$\frac{941}{820}$	866 787	764 678	503 457	265 264	$1,083 \\ 203 \\ 164$	$1,217 \\ 166 \\ 127$	1,088 185	895 338	782	1,069	
Infancy	$ \cdot $ $\frac{\tilde{N}}{E}$	663	697 543	695 571	703 608	686 562	719 579	$734 \\ 616$	656 561	137 683 504	309 614 528	666	680	6,176 $8,196$
Old Age	N	692	664 567	629 548	671 566	$\begin{array}{c} 754 \\ 631 \end{array}$	857 697	905 748	873 726	836	733 628	521 722 581	532 732 570	6,705 9,068 7,579
Total all Causes	M		9,681 7,667	$9,469 \\ 7,391$	$9,633 \\ 7,724$	$9,604 \\ 7,702$	9,881 7,897	$10,411 \\ 8,279$	$\frac{-}{10,309}$ $8,411$	10,215 7,895			10,146	

TABLE CLIV.—Shewing for each Equalised Month the Average Relative Frequency of Death due to Various Causes, the Population being Constant throughout the Year. Based upon 9 Years' Experience (1907-1915). Australia.

CAUSE OF DEATH, S	ex Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Typhoid Fever	M 1.589 F 1.567	1.657 1.844	$1.773 \\ 1.905$	1,599 1,436	1.199	.779	.449	.391	.357	.367	.663	1.179	12.000
Whooping Cough	M   1.139	.942	.630	.664	$\frac{1.178}{.910}$	.979 $.930$	$.494 \\ .975$	$\frac{.320}{1.176}$	1.288	$\frac{.304}{1.095}$	$\frac{612}{1.138}$	$1.071 \\ 1.144$	$12.000 \\ 12.000$
Diphtheria and Croup	F 1.185 M .752	.978 .706	$.835 \\ .921$	.742 $1.141$	1.381	1.426	$\frac{1.082}{1.316}$	$\frac{1.107}{1.015}$	$\frac{1.205}{.948}$	$\frac{1.206}{.790}$	$\frac{1.105}{.776}$	1.052	$12,000 \\ 12,000$
Influenza	F .810 M .468	$.752 \\ .332$	.739 $.349$	$1.258 \\ .463$	$1.295 \\ .657$	$\frac{1.414}{.840}$	$\frac{1.241}{1.199}$	$\frac{1.098}{1.982}$	2.281	.774 1.707	0.914 $1.134$	.711	
	F .580 M .961	$.332 \\ .912$	$.345 \\ .917$	$\frac{.434}{910}$	$\frac{.550}{1.012}$	$\frac{.676}{1.006}$	1.140 1.118	$\frac{1.942}{1.100}$	$\frac{2325}{1.086}$	$\frac{1.779}{1.049}$	1.182 $1.003$	.714	12.000
	F   1.001 M   1.027	0.919 $1.062$	.929 $.975$	$\frac{.976}{1.029}$	.971	.973	1.013	1.121	1.061	1.112	.943	.981	$12.000 \\ 12.000$
	F 1.011 M .839	1.037	1.012	1.015	1.029	.979	.954	.959	.998 $.971$	$\frac{1.036}{1.007}$	1.164 $1.016$	.998	$12.000 \\ 12.000$
	F .834 M .942	.837	.767	.901	.952 $.929$	1.235 $1.056$	$\frac{1.123}{1.148}$	$1.224 \\ 1.102$	$1.047 \\ 1.232$	$\frac{1.041}{1.124}$	0.938 $1.012$	1.052	$12.000 \\ 12.000$
Heart	F .983	.864 .831	.884 .882	$.917 \\ .904$	.995 .945	$\frac{1.096}{1.130}$	$1.159 \\ 1.288$	$\frac{1.179}{1.208}$	$\frac{1.095}{1.058}$	$\frac{1.020}{1.008}$	.974		$12.000 \\ 12.000$
System	M .703 F .671	.599 $.611$	.690 .610	$.784 \\ .752$	.929 $.935$	$1.161 \\ 1.157$	$\frac{1.392}{1.400}$	$\frac{1.480}{1.573}$	$\frac{1.411}{1.407}$	$\frac{1.112}{1.157}$	.968	.771	$12.000 \\ 12.000$
	M   1.725 F   1.737	$1.590 \\ 1.594$	$\frac{1.463}{1.530}$	$\frac{1.290}{1.317}$	.850 .889	$.448 \\ .512$	$.344 \\ .319$	$.281 \\ .246$	$.312 \\ .266$	.570 .600	$\frac{1.321}{1.252}$	1.805	$12.000 \\ 12.000 \\ 12.000$
1	M .971 F 1.038	$1.020 \\ .971$	$1.017 \\ 1.002$	$\frac{1.030}{1.089}$	$\frac{1.004}{1.005}$	$\frac{1.053}{1.037}$	$\frac{1.075}{1.102}$	.961 1.003	.999	.899 .945	.975	.996	12,000
	M .916 F .996	.878 .897	.833 .868	.888	.997	1.134 $1.103$	1.197 $1.184$	1.155	1.106	.970	.955	.969	$12.000 \\ 12.000$
Total all Causes I	M 1.047	.974	.952	.969	.966			1.150	1.089	.995	.920	.903	12.000
	F 1.034	.973	.938	.980	.977	1.002	$\frac{1.047}{1.050}$	$\frac{1.037}{1.067}$	$\frac{1.027}{1.002}$	.963 .977	$1.004 \\ .990$		$12.000 \\ 12.000$



The distances from the centres of the circles shew the average ratios of the deathrate per month to the average rate for the entire year, the ratios for males being denoted by firm lines, and those for females by dotted lines, the succession of months being clockwise. In the case of absence of fluctuation the sector-boundaries would all be on the circle marked "1," e.g., "Cancer." In the case of "Influenza" it will be seen that the September rate is more than double the average for the year.

33. Studies of particular causes of death: voluntary death.—Although the study of particular causes of death might appear not to belong to the general theory of population, it is really an essential. For example, if diseases, the incidence of which is characteristic of earlier life, be combatted, the consequence will be an increase in deaths from those which

characterise later years (e.g., tuberculosis and cancer). Again statistics of voluntary death or suicide, are of special importance, inasmuch as they disclose the regularity of human conduct even in matters which might be thought to be peculiarly under individual control, and be imagined to lie outside regular law. But suicide follows well-defined laws, and even as regards the mode of death the regularity is remarkable, as the following table shews:—

TABLE CLV.—Mode of Voluntary Death. Australia 1907-15.

•			Nι	ımber	of Su	icides.				.	to		Ra	nge.	
Mode of Death.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.	Totals.	Ratio to Aggregate.	Lowest (a).	Mean.	$\begin{array}{c} {\rm Highest} \\ {\it (b).} \end{array}$	Mean of $(a)$ & $(b)$ *
Poison Asphyxia Hanging and Strangulation Drowning Firearms Cutting Instruments Precipitation from Height Crushing Other	57 2 71 37 129 61 6 3 19	88 1 68 31 146 54 4 6 15	2 67 24 138 74 7 5 11	72 42 134 79 3 8 15	69 43 133 65	79 34 168 76 0	$\begin{array}{c} 2 \\ 79 \\ 25 \end{array}$	72 30 201 76 4 2	0 84 38 196 89 4 8	868 15 661 304 1,408 662 36 56 165	.2079 .0036 .1583 .0728 .3373 .1586 .0086 .0134 .0395		1.7 73.4 33.8 156.4 73.6 4.0 6.2	84 38 201 89 7	92.5 2.0 75.5 31.0 165.0 71.5 6.0 22.0
Total, Males	385	413	398	432	446	514	516	534	537	4,175	1.0000	385	464	537	461
Poison Asphyxia Hanging and Strangulation Drowning Firearms Cutting Instruments Precipitation from Height Crushing Other	32 0 12 19 3 5 1 2 2	35 0 15 14 7 6 2 2	0	10 19 6	52 1 10 13 9 9 2 0	0 12 11 10 8 0 1	$\begin{array}{c} 1 \\ 22 \\ 14 \end{array}$	15 17 4	18 21 5 6 3 2	3 123 147 59 59	.5201 .0033 .1338 .1600 .0642 .0642 .0152 .0120 .0272		0.3 $13.7$ $16.3$ $6.6$ $6.6$ $1.6$ $1.2$	1 22 21 10 13 4 2	54.0 0.5 15.5 16.0 6.5 8.0 2.0 4.0
Total, Females	76	84	97	84	98	118	131	109	122	919	1.0000	76	102	131	103
Ratio of Females to Males Ratio of Males to Females	.197 5.07	.203 4.92	.244 4.10	.194 5.16	.220 4.55		$\frac{.254}{3.94}$	.204 4,90		.220 4.54		.194 3,94			2.37 4.55

\* It is worthy of note that the mean of the highest and lowest number of suicides in any year is sensibly equal to the arithmetic mean. The male population increased about 18.40 per cent. on the period covered, and the female 21.82 per cent.

The ratio of the total females of age 16 and above, to the total males of 16 and above, was about 1.10904, and of 21 and above was 1.12391. This would indicate a frequency of 4.097, or 4.042 to 1 for male, as compared with female suicides. But this relative frequency is very variable. On the whole it is rapidly increasing. The ratios of the death-rates of males and females according to age are as follow, viz.:—

Age. Ratio of	10-14	15–19	20-24	25-29	30–34	35-39	40–44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89
Death Rates Smoothed	1.7	0.37	2.15	3.01	3.25	4.32	5.09	3.93	6.17	5.14	7.86	10.67	9.07	14.27	28.79	œ
Ratio	.74	1.37	1.99	2.62	3.25	3.88	4.51	5.13	5.76	6.39	7.30	8.80	11.50	15.60	28.80	?

These results shew that the ratio of the rate of suicide by men to that of suicide by women increases about 0.125 per annum till about age 60, when it becomes more rapid. The general result is, that this rate  $\rho$  can be expressed between the ages 10 and 57.5 as:—

$$(652).....\rho = 0.1256 (x - 6.63)$$

after which the points lie upon the curve indicated by the numbers 6.39, 7.30, etc., in the preceding result as smoothed.

The annual fluctuation of suicide is fairly well-defined. By correcting the results so as to make them represent what would have been furnished by records of equal months, and a constant population 1 (as at the middle of the period), the following values are obtained, viz.:—

TABLE CLVI.—Number of Suicides per diem in a Population of 1,000,000 Persons.

Australia, 1900 to 1915.

Period.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900-1909* 1907-1915	.359	.371 ,356	.335 .326	.336	.310 .306	.284 .262	.301	.326 .295	.307	.353 .358	.323 .356	.345 .381

<sup>\*</sup> These results are given by  $0.3291 + 0.0354 \sin{(x + 72^{\circ} 4^{\circ})} \rightarrow 0.0117 \sin{2(x + 73^{\circ}.22^{\prime})} + 0.0031 \sin{3(x + 12^{\circ} 49^{\circ})} \rightarrow 0.0142 \sin{4(x + 40^{\circ} 52^{\prime})} \rightarrow 0.0131 \sin{5(x + 0^{\circ}.16^{\prime})} + 0.0104 \sin{6x}$ : Journ. Roy. Soc. N.S.W., xlv., p. 99.

The final mean results probably do not define the curve representing an indefinitely large number of cases. The results given are based upon only about 10,000 cases, and at least 10 times this number would be necessary to get satisfactory results. The distribution is more likely to be of the form. <sup>2</sup>

(653)..
$$y = A + B \sin x + C \cos x = A + b \sin (x + \beta) + c \cos (x + \gamma)$$
  
(654).. $A = (\Sigma_1^n y)/n$ ;  $B = b \cos \beta - c \sin \gamma$ ;  $C = b \sin \beta + c \cos \gamma$ .

<sup>&</sup>lt;sup>1</sup> The population records give for the population at the middle of each month the following results, 00 omitted:—

Jan.
 Feb.
 Mar.
 April.
 May.
 June.
 July.
 Aug.
 Sept.
 Oct.
 Nov.
 Dec.

 Males—209,686
 210,012
 210,338
 210,662
 210,983
 211,305
 211,305
 212,039
 212,421
 212,834
 213,278
 213,723

 Females—194,153
 194,513
 194,873
 195,054
 195,055
 195,056
 195,442
 196,211
 196,981
 197,766
 198,567
 199,369

<sup>&</sup>lt;sup>2</sup> See "Studies in Statistical Representation" (Statistical Applications of the Fourier series), by G. H. Knibbs, Journ. Roy. Soc., N.S.W., xlv., pp. 76-110, 1911; in particular pp. 97-110.

### XVI.—MIGRATION.

1. Migration.—The effect of immigration, and indeed of migration generally, is to modify the age, sex, and race constitution of a community, and these facts are well illustrated in the statistics of any new country (e.g., the Commonwealth of Australia). Concentrations of population due to seasonable or similar influences, or from other causes, may also become a factor of importance from particular points of view. For example, statistics of morbidity or of mortality, the object of which is to differentiate between urban and country hygienic conditions, may be materially affected even by temporary concentrations of populations in cities; for example, by the fact that serious impairments of health may lead to transfer to the cities for special treatment, with a consequent increase of the mortality and morbidity rates; and so on. Certain obvious economic consequences may, too, arise from such concentrations. For these reasons statistics for particular purposes are often limited as regards precision.

In countries where the migration of adults is a striking characteristic, the constitution of the population according to age ceases to be normal; but the aggregates obtained by inclusion of the group of countries between which the migration takes place, tend to restore the normality. In Australia financial arrangements between the component States have, among other things, led to records being kept (a) of oversea migration, (b) of interstate migration by sea, and to a partial record (c) of overland migration. All of these shew fluctuations of annual period.

Records of overland migration by road are not kept, but such migration is assumed to be in balance, that is to say, the immigration and emigration are supposed to be equal. It will be seen later that overland immigration by rail virtually balances the overland emigration.

2. Proportion born in a country.—The correlation of birth-place and age in any population is of sociologic importance. In the following results, from the 1911 Australian Census, the "unspecified" cases (as to whether the birth-place was Australia or outside of Australia) have, for each age-group, been distributed in the proportion of the numbers given as born in and out of Australia, respectively. The results are as shewn in Table CLVII. hereunder and in Fig. 106. These disclose the fact that the initial preponderance of persons born in Australia diminishes very rapidly with age; this of course being due to the fact that the commencement of colonisation was at a point of time nearly identical with the birth of the present oldest inhabitants.

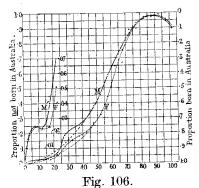
 $<sup>^{1}\,\</sup>mathrm{An}$  analysis of the Australian population will be found in the Census Report, Vol. I., pp. 120-125.

TABLE CLVII.—Shewing according to Age and Sex the Proportion of Persons Living in but not Born in Australia.<sup>1</sup>

Age last Birth-	Bor	tion not n in ralia.	Age last Birth-		ion not n in ralia.	Age last Birth-	Bor	tion not n in tralia.	Age last Birth-	Bor	tion not n in tralia.
day.	Males.	Females	day.	Males.	Females	day.	Males.	Females	day.	Males.	Females
0 1 2 3 4 5-9 10-14	.0036 .0106 .0160 .0202 .0215 .0249 .0239	.0036 .0103 .0166 .0193 .0207 .0242 .0232	$\begin{array}{c} 15-19\\ 20-24\\ 25-29\\ 30-34\\ 35-39\\ 40-44\\ 45-49 \end{array}$	.0403 .0699 .1866 .2290 .2538 .3007 .3834	.0243 .0513 .1100 .1531 .1806 .2083	50-54 55-59 60-64 65-69 70-74 75-79 80-84	.4536 .5875 .7014 .7572 .8880 .8952 .9731	3244 4915 .6485 .7181 .8653 .9318 .9637	85-89 90-94 95-99 00 and over	.9792 .9781 .9569 .9143	.9756 .9886 .9449 .8966

The results in the table are graphed in Fig. 106, the Curves M, M' and F, F' denoting respectively the results for males and females. The

## Proportions born in Australia.



Curves M and F shew respectively the proportion of males and of females born in Australia. Curves M' and F' are plotted on ten times the vertical scale of Curves M and F.

irregular form of the curves is due to the age-peculiarities of the migration. As the population develops by natural increase the curves will tend to become similar to the dotted forms, the F and M curves to become identical, and both will approach more and more the baseline.

It might be supposed that by comparing the Census results with the birth-registration results, reduced according to the mortality, so as to shew the number of survivors, the excess of immigrants over emigrants would appear. Such is not the case, however, notwithstanding the striking

regularity of the results: see Census Report, Vol. I., pp. 93-94.

<sup>1</sup> See Census Report, Vol. II., pp. 130-1 for males, and pp. 132-3 for females. The unspecified according to age have been ignored. Let the total T of either sex be made up of I those born in Australia, O those born outside, and U the unspecified. Then the adjusted numbers I' and O' will be respectively,  $I' = I \cdot T/(T-U)$ ;  $O' = O \cdot T/(T-U)$ .

Item.		N.S.W.	Vict.	Q'land.	S. Aus.	W. Aus.	Tas.	Total. (Cwlth.)
No. of Males No. of Females Ratio of excess	 M	22,957 $22,136$ $.0282$	15,869 15,089 .0183	8,329 $7,967$ $.0346$	5,378 $5,124$ $.0444$	$3,808 \\ 3,684 \\ .0373$	2,761 $2,584$ $.0120$	59,102 56,584 .02774
of reduced registration	F	.0321	0323 $0251$	0336 $0341$	$0357 \\ 0402$	0.0231 $0.0303$	$0240 \\ 0178$	03174 $02970$

These excesses, ranging from about  $1\frac{1}{4}$  to about  $4\frac{1}{2}$  per cent., are only in part accounted for by the migration of infants (see p. 94 above referred to), in fact only one-tenth may be referred to migration. They disclose the necessity of fixing the age exactly by recording the *date of birth*. The practice of accepting loose statements as regards age is from every point of view most unsatisfactory for the purposes of accurate tabulation.

3. Correlation, owing to migration, between age and length of residence.—The length of residence of the proportion of persons not born in Australia, shewn in Table CLVII. and Fig. 106, is furnished by data given in the Report of the Census, Vol. II., pp. 392-393. The middle of the age and length-of-residence groups may be regarded as a sufficiently accurate indication of the average value in both cases. It will then be seen that, for any given length of residence, there is an age at which the numbers are a maximum.

The maximum values are—for males—about as follows:—

				TAT	A,LES,							
Average length of residence (yrs.)	0-1	1-2	2-3	3-4	4-5	5-10	10~15	15-20	20_25	25-30	20. 25	35-40
Age giving maximum numbers (yrs.)	24.2	24,7	26.3	27.6	28.6	30.3	34.6	39.7	44.0	49.0	53.8	58.6
Approx. numbers Total (and average) in	9,590	4,420	3,180	2,430	1,460	868†	1,148†	1,040†	3,000†	(31.6) 3,600†	2,200†	1,120+
age group	39,228	17,571	12,760	9.347	5,816	3,644	4,440	4,315	11,478	(1210)+ 13,946	8,386	(446)† 4,563

† These maximum numbers correspond to the maximum ages on the two lines above.

The above results shew that the curves are dimorphic and consequently that the relation between the frequency of migration and the age of the migrants is not simple. This is to be expected in a new country, where special tendencies in migration are likely to be in evidence from time to time. The complete record of migration requires that migration should be tabulated according to age, and for some purposes a Census is preferably tabulated under the headings "age at entry into the Commonwealth," and "duration of residence." Only in this way can the relation between age and frequency be accurately and conveniently ascertained.

Before dealing in detail with the several classes of migration, the general | theory |may be indicated.

4. The theory of migration.—Migration, either into or out of any territory, varies according to age and sex. The character of these variations change greatly from time to time, when long periods are considered, but are ordinarily fairly constant for short periods. As between place and place, it is, no doubt, other things being equal, also a function of their distance apart.

 $<sup>^1</sup>$  This is analogous to the tabulating with the headings " duration of marriage" with "age at marriage" instead of "age at the Census."

Let the ratio of the number migrating (T) in a unit of time (1 year) to the population (P) in which it occurs, be called the *migration ratio*  $(\tau)$ ; then we shall have:—

$$(655).....\tau = T/P = \Sigma_1^n T / \Sigma_1^n P$$

the last expression giving the weighted average over the n years included. That is, it is the ratio of the sums of the migrants to the aggregate of the mean populations of the same years.

Let the number of migrants consist of  $T_m$  males and  $T_f$  females, then the ratios of each of these to their sum may be called the *sex-ratios* a and  $\gamma$  respectively, 1 of the migration. Thus:—

$$(656)....a = T_m/(T_m + T_f); \gamma = T_f/(T_m + T_f).$$

Thus we shall have for the annual number of male and female migrants, respectively:—

$$(657)....T_m = P\tau a ; T_f = P\tau \gamma.$$

The male and female "migration ratios," however, are given by

$$(658).....\tau_{a} = T_{m}/M; \ \tau_{\gamma} = T_{f}/F;$$

and if the number of males and females in the population be equal, we shall have:—

$$(659).....\tau_a = 2a.\tau; \tau_{\gamma} = 2\gamma.\tau.$$

The components of the fluctuation of annual period are distinctly traceable—in many cases the causes can be assigned.

The "migration ratio"  $\tau$  is not a population-ratio indicating the number of different persons migrating: it merely represents the relative quantity of migration independent of the individuals. It has a fluctuation of annual period, and minor periods within that, and these can be represented and dealt with as already indicated, see Part III., § 5, pp. 39, 40, in particular formulæ (90) to (101), and Part XI., §§ 16, 17, pp. 169-172.

<sup>&</sup>lt;sup>1</sup> The first letters of ἀνήρ and γυνή,

The "migration-ratio" is a function of age and of time, and is probably in all cases polymorphic, that is:—

(660)..... 
$$\tau = \phi(x) = \Sigma(A'e^{\frac{1}{nx}}), \text{ or } = \Sigma(Ax^me^{-nx'})$$

in other words, it may be regarded as the sum of a series of curves of one or both of the types shewn, see formulæ (23) to (39a), pp. 22 to 24, and formulæ (147) to (156), pp. 52 to 55. Like nearly all statistical curves it will probably not conform exactly to any simple expression. The variation with time will ordinarily be considerable in new countries.

The characteristics of the annual fluctuations are not quite identical for the sexes: hence each of the components  $(T_m \text{ and } T_f)$  may be analysed separately, or the total  $(T_m + T_f)$  may be analysed, and the fluctuation of the sex-ratio, determined for individual months, may be analysed.

5. Migration-ratios for Australia.—The migration-ratios for Australia, determined as indicated by formulæ (655) to (659), are as follow:

TABLE CLVIII.—Shewing the Migration-ratios for Australia and the Sex-ratios of the Migration for Oversea and Interstate Sea Migration and for Migration by Railway.

	07	ERSEA I	MIGRATIO 9-1913.	ON,	INTER	STATE S 1909-		ATION,			Migrati 1914-19	
To (I) or from (E)	Males.	Fe- males.	Per- sons.	Ratio Males to Total.	Males.	Fe- males.	Per- sons.	Ratio Males to Total.	Males.	Fe- males.	Per- sons.	Ratio Males to Total
N.S.W. I E Vic. I E Qid. I E S. "Aus. I E W. Aus. I Tas. I E	.05237 .03654 .02195 .01376 .02284 .00928 .02199 .01130 .05561 .02308 .02129 .00910	.02644 .01751 .01336 .00788 .01472 .00267 .01048 .00372 .03502 .00963 .01104 .00566	.04003 .02748 .01763 .01080 .01912 .00626 .01632 .00757 .04676 .01730 .01630 .00742	.68549 .69666 .61875 .63298 .64953 .80570 .68336 .75729 .67788 .76057 .66986 .62842	.04557 .04394 .07226 .07313 .05516 .05028 .05873 .05502 .07460 .08202 .22592 .24873	.03251 .03095 .04807 .04766 .03251 .03137 .03534 .03463 .07593 .16258 .18082	.03935 .03775 .06009 .06032 .04482 .04165 .04720 .04497 .07386 .07940 .19505 .21564	.60666 .60976 .59749 .60242 .66902 .65623 .63097 .62041 .57566 .58876 .59379	.18966 .19104 .19580 .19071 .16804 .16970 .22646 .23406	.09635 .09447 .07766 .08047 .11287 .11476 .10576 .10170	.14426 .14406 .13582 .13474 .14238 .14413 .16490 .16655	.67506 .68094 .70974 .69681 .63129 .62984 .67288 .68857

The table shews that as regards oversea migration, immigration is preponderant: in interstate sea migration it is also generally preponderant, the exceptions being—Victoria, "males" and "persons"; Western Australia, "males," "females" and "persons." Interstate migration by railway shews an approximate equality between immigration and emigration, the balance on either side being variable.

That these results have very accordant values from year to year will appear from the following table ;—

TABLE CLIX.—Interstate Immigration by Sea, 1909-1913.

		Migra	ation-ra	tios.	Male is to gr'nts		Migra	ation-ra	tios.	Male ts to gr'nts	٠. نه	Mig	ration-r	atios.	of Male ants to Miorn'ts
Year	State	Males.	Fe- males.	Per- sons.	95099 Wigrant Potal Migrant ria. State	Males.	Fe- males.	Per- sons.	Ratio of M Migrants Total Migr'	State.	Males.	Fe- males.	Per- sons.	Ratio of Migran	
1909 1910 1911 1912 1913	N.S.W.*	.0401 .0408 .0487 .0488 .0454	.0278 .0294 .0347 .0359 .0320	.0343 .0354 .0420 .0427 .0390	.6134	Victoria.	.0651 .0670 .0747 .0763 .0714	.0407 .0442 .0504 .0526 .0491	.0528 .0556 .0625 .0644 .0603	.6099 .5994 .5967 .5915 .5931	Q'land.	.0575 .0521 .0559 .0522 .0557	.0323 .0323 .0323 .0311 .0320	.0460 .0430 .0452 .0425 .0448	.680 .657 .671 .664 .671
1909 1910 1911 1912 1913	S. Aust.	.0536 .0555 .0605 .0610 .0578	.0315 .0349 .0371 .0362 .0337	.0427 .0453 .0490 .0488 .0458	.6356 .6209 .6278 .6352 .6351	W. Aust.	.0693 .0790 .0783 .0709 .0698	.0691 .0757 .0753 .0707 .0664	.0692 .0776 .0770 .0708 .0683	'5705 .5808 .5811 .5694 .5756	Tas.	.1886 .2017 .2210 .2465 .2464	.1331 .1396 .1606 .1792 .1829	.1614 .1713 .1862 .2139 .2158	.596 .600 .588 .593

<sup>\*</sup> Excluding Federal Territory.

TABLE CLX.—Shewing for the Years 1909 and 1913\*, the Ratio of Male Migration to the Total Migration†, and the Proportion of Males, Females and Persons, under 12 Years of Age, to the Total Number of Emigrants. Australian Interstate Migration by Sea.†

States from	N.S. Wales.	Victoria.	Queensland.	S. Australia.	W. Australia.	Tasmania.
To N.S. Wales.	,	Masc. M066 , .059 .607 F095 .600 , .085 P078 , .069	.665 F112 .667	.591 F109 .599103 P095	.573 F212 .598 , .163 P183	Masc. M095 , .087 .518 F079 , .098 P087
To Victoria.	Masc. M061 063 .612 F086 .578 ,, .082 P071 ,, .071		Masc. M084 .085 .649 F119 .600122 P096 .,100	.647 F122 .677099 P085	.53 <b>9</b> F196	Masc. M061 , .059 .618 F088 .600 , .096 P071
To Queensland.	Masc. M059 063 .687 F126 .678	.649 F136 .642		Masc. M033 .109 .831 F160 .567155 P054 129	.610 F067 .525 , .263 P091	Nil.
To S. Australia.	Masc. M095 	.659 F113 .674109 P080	.427 , .070 P030		Masc. M112 ,, .106 .629 F189 .635 ,, .161 P140 ,, .126	Masc. M024 ,, .000 .971 F053 .348 ,, .000 P029 ,, .000
To W. Australia.	.556 F193	.543 F184 .170 P181	.340 F121	.607 F191 .620158 P148		Masc. M097 , 417 .633 F056 .343 , .087 P082 ,, .200
To Tasmanja.	Masc. M080 , .081 .483 F072 .494 , .087 P076 ,, .084	.620 F .082 .612	.409 F100 154 P100	Nil.	Nil.	

<sup>\*</sup> The upper figures are for the year 1909, the lower for the year 1913. † The masculinity of the migration in the table is the ratio of males to persons. ‡ Based upon the departures from and arrivals in the States indicated,

6. Periodic fluctuations in migration.—Periodic fluctuations of migration are exhibited alike by oversea migration, by interstate migration by sea, and by migration overland. The following tables give the variations for the first and second for Australia. Table CXLI. shews also the monthly variations of the sex-ratio (or masculinity) of the migration. To express these results by Fourier series, see Part III., § 5, pp. 38-40, and also Part XI., § 16, pp. 169-171.

TABLE CLXI.—Shewing Oversea Migration into and from Australia during the period 1909-1913, and its Fluctuations for "Persons" during the Year. (For equalised months and a constant population).

	I	Totals	for 1909	-13.												Ī
State.	or E	Persons.	Males.	Females	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.S.W.	I	337,997	231,634	106,303	8.39	1.110	1.180	1.096	.989	.992	.792	.876	.920	.985	1.091	1,070
	E	232,056	161,666	70,390	1.002	1.101	1.316	1.227	1.101	.884	.848	.806	.761	.896	.976	1.082
Masc.	I	.6855			.697	.665	.698	.679	.708	.708	.723	.689	m .694	.679	.659	.689
_	Е	.6967	••		.692	.670	,642 m	.680	.712	.707	.721	.735	.709	.716	m .712	.705
Vict.	I	116,603	72,148	44,455	.883	1.040	.990	.914	1.105	.856	.756	.832	.994	1.024	1 234	1.372
	E	71,425	45,211	26,214	1.189	1.288	1.529	1.386	.974	.801	.766	.627	.602	.720	.877	1.241
Masc.	I	.6187			.632	.612	.593	.637	.652	.659	.645	.6 <b>36</b>	m $.628$	.613	.594	.565
	E	.6330	• • •	,,	.663	.620	.580 m	.601	.631	.652	.658	.689	.664	.658	.649	$_{.626}^{m}$
Qld.	I	58,507	38,002	20,505	.850	.717	1.114	.743	.963	1.165	.855	.989	1.172	1.264	.938	1.230
	E	19,161	15,438	3,723	1.125	m $1.244$	1.434	1.243	1.022	.801	.697	.709	.777	.895	1.062	.991
Masc.	I	.6495			.650	.670	.595	.677	.672	.688	m .637	.628	.711	.626	<b>.6</b> 70	.592
	E	.8057	••		.890	.854	.840	.702 m	.748	.777	.775	.812	.841	.848	.863	$_{.865}^{m}$
S. Aust.	I	33,496	22,890	10,606	.902	1.004	1.037	.918	1.038	.854	.840	.731	.816	1.050	1.796	1.014
	E	15,529	11,760	3,769	.939	1.305	1.699	1.480	1.084	.808	.719	$\frac{m}{.723}$	.684	.726	.880	.953
Masc.	I	.6834			.733	.713	.714	.721	.654	.652	.698	.762	$\frac{m}{.747}$	.708	.568	.659
	E	.7573			.833	.769	.680 m	.691	.761	.811	.791	.826	.789	.802	m .744	.737
W. Aust.	I	67,168	45,532	21,636	1.389	1.169	.702	.847	1.059	.860	1.095	.594	.842	.811	1,556	1.076
	E	24,846	18,897	5,949	.932	1.058	1.436	1.298	1.198	.895	.796	$\frac{m}{.797}$	.641	.679	.897	1,373
Masc.	Ι	.6779			.715	.703	.746	.724	.682	.662	.654	.708	m .612	.653	.610	.707
	E	.7606		• •	.793	.750	.683 m	.709	.718	.758	.772	.801	.806	.788	m .781	.838
Tas.	I	15,633	10,472	5,161	.841	1.105	1.279	1.169	1.029	1.036	1.002	.840	1.040	.833	.821	1,005
-	E	7,121	4,475	2,646	1.518	1.582	1.732	1.427	.755	.639	.499	.561	.590	.952	m .625	1,120
Masc.	Ι	.6698			.622	.641	.686	.705	.704	.696	$_{.689}^{m}$	.671	.675	.814	.624	.648
	E	.6284			.685	.580	.553 m	.583	.612	.652	.628	.637	.671	.722	.607	.690

The quantity underlined is the greatest, and that marked m the least during the year. The two upper figures in each section are the relative average magnitudes of the migration for the monthly the monthly average for the year being unity.

The two lower figures are the migration-ratios for the corresponding months, viz., the ratio of the migrants to the population of the State.

In Table CLXII. hereunder the fluctuations of interstate migration by sea are shewn, and the "migration-ratios" are also shewn.

TABLE CLXII.—Shewing the Fluctuations for "Persons" in the Interstate Migration by Sea in Australia for the Period 1909-1913.

(For equalised months and a constant population and the migration ratios  $\times 1,000,000$ .)

State.		F	LUCTUA	TION R	ATIO (T	OTAL =	12.000	) AND M	IIGRATI	ON-RATI	os for	PERSON	8.
Suuc.	Mi- grants.	Jan.	Feb.	Mar.	April.	Мау.	June.	Jaly.	Aug.	Sept.	Oct.	Nov.	Dec.
To— Victoria	137,916	1.545	1.254	1.045	1.157	.891	.663	.595	.641	.797	1.164	.965	1.28
	16,344	2,105	1,707	1,423	1,575	1,214	903	810	873	1,085	1,586	1,314	1,74
Q'land	109,542	1.195	1.011	1.059	1.225	1.318	1.256	.952	.883	.782	.706	.711	.90
	12,982	1,293	1,094	1,146	1,325	1,425	1,359	1,030	955	846	764	769	91
S. Aust	20,788	1.243	1.194	1.485	1.325	1,096	.776	.622	.592	.744	.860	.879	1.1
	2,464	255	245	305	272	225	159	128	122	153	176	180	2
W. Aus	t. 16,218	1.068	1.253	1.270	1.366	1.333	.809	.683	.636 m	.763	.858	.871	1.1
	1,922	170	200	202	218	212	129	109		122	137	139	18
Tas.	33,517	1.991	1.858	1.200	.907	.498	.437	.460	.448	.661	.730	.827	1.9
	3,972	659	615	397	300	165		152	148	219	242	274	6
N. Ter	825	.83	.60	.97	.217	.128	.108	.102	.87	.59	.93	.73	
l	98	7	5	8	18	10	) (	) 8	3 7		8	6	
Total	318,806	1,425	1.228	1.106	1.178	1.035	.859	.710		.772	.925	.852	1.2
	37,781	4,489	3,866	3,482	3,708	3,25	2,704	2,237	2,20	2,429	2,911	2,682	3,8
ſ N,S.W.	145,326	1.354	1.274	1.343	1.297	.951	.78	.629		.748	.709	1.088	1.2
	21,978	2,479	2,333	2,458	2,376	1,75	1,35	2 1,151	1,11	7 1,361	1,298	1,992	2,3
Q'land		'	.909	.987	1.187	1.46	1.51	1.279	1.03	.760		.652	.6
	3,906	304	296	321	387	47	7 49	8 414	330	6 247	m $197$	212	2
S. Aus	t. 28,000	1.266	1.231	1.233	1.212	1.08	.78	7 .70			.778	1.050	1.2
"	4,23	5 447	438	435	428	38	2 27	8 247	7 22		5 279	371	4
or of the state o	46,03	1 1,08	1.339	1.438	1.307	1.22	.92	6 .71	.72	9 .71	.703 m	.864	3.
	6,96	62	777	839	5 758	70	53	7 41	5 42	2 415		501	. 5
Tas.	153,56	8 1.61	1.25	3 1.04	1.009	.68	3 .59	4 .65	.60	2 .74	.78	1.112	1.9
	23,22	0 3,120	3 2,42	2,01	3 1,952	1,32		9 1,26	1,16	4 1,44	7 1,520	2,151	3,6
N. Ter	r. 15	6 .92	.10	0 1.4	6 .39	2.4	6 1.1	5 .7	7 .9	2 1.3	8 .3	1.60	
	2	4	2 *************************************	1 :	3	1	5	2	1	2	3 .	6 3	1
Total	398,91	5 1.39	0 1.24	6 1.20	7 1.17	4 .92	5 .75	8 .69		9 .74	.73	6 1.041	1.4
	60,31			6 6,06	6 5,90	1 4,64	9 3,81	0 3,49	$\begin{array}{c c} m \\ 3,26 \end{array}$	4 3,74	3,69	7 5.230	7,5

TABLE CLXII.—Shewing the Fluctuations for "Persons" in the Interstate Migration by Sea in Australia for the period 1909-13—continued.

		)	FLUC	TUATIO	n Ratio	ATOT)	T. = 12.	000) AN	d Migr	LATION-	RATIOS I	for Pei	rsons.	
_	State.	Mi- grants.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	N.S.W.	106,280	1.140	.957	.976	.890	.811	.781	.788	.905	1.036	1.057	1.037	1.622
25		34,731	3,300	2,769	2,825	2,578	2,347	$\frac{m}{2,261}$	2,282	2,619	2,998	3,058	3,001	4,693
0,02	Vict.	19,664	1.088	.914	.818	.959	.721	.773	.785	1.039	1.131	1.205	1.071	1.496
3,060,025		6,426	582	490	438	514	$\frac{m}{386}$	414	420	556	606	645	573	801
l!	S. Aust.	593	1.23	.69	.93	.92	1.78	.63	1.11	.97	.69	1.03	1.05	.97
ď	] ]	194	20	10	20	14	29	m 10	17	16	11	16	17	16
ınd.	W. Aust.	325	1.11	1.22	.85	2.14	1.85	.85	.52	.59	,92	.89	.29	.77
From Queensland	l	116	10	11	8	19	16	8	5	5	8	8	m 3	7
Jue	Tas.	62	0.0	4.8	4.7	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
om (		20	0	8	8	m								
Fr	N. Terr.	529	.79	.93	.95	1.47	.89	1.09	.77	1.16	1.11	1.04	1.13	.67
	Ĺ	173	11	13	14	21	13	16	11	17	16	15	16	<b>"</b> 9
	Total	127,453	1.130	.952	.953	.908	.804	.780	.788	.926	1.049	1.078	1.040	1.592
	-	41,651	3,924	3,302	3,307	3,151	2,791	$\frac{m}{2,708}$	2,736	3,213	3,640	3,743	3,610	
_			,			-,	,	,	7,	-,				'
1	N.S.W.	22,115	1.285	1.422	1.494	1.231	.956	.694	.591	.560 m	.772	.870	.855	1.270
2052589.		10,774	1,153	1,277	1,341	1,105	858	623	531	503	693	781	768	740
= 20	Vict.	25,828	1.222	1.445	1.188	1.069	.770	.793	.673	.626	.749	1.105	1.027	1. <b>3</b> 33
P.		12,583	1,281	1,515	1,245	1,121	807	831	706	657	786	1,160	1,077	1,397
e d	Q'land.	1,019	.77	1.21	.84	1.07	1.17	1.25	.98	.84	1.18	1.03	. <b>6</b> 6	1.00
trali		496	32	50	35	44	48	52	40	35	49	43	27	42
Aus	W. Aust.	43,341	1.128	1.275	1.317	1.185	1.049	.869	.800	m	.786	.911	.896	1.001
From S. Australia.		21,115	1,984	2,243	2,318	2,086	1,845	1,529	1,408	1,377	1,383	1,603	1,577	1,760
Fron	Total	92,303	1.188	1.357	1.318	1.163	.950	.810	.717	.686	.777	.956	.920	1,158
		44,969	7,941	8,348	7,501	6,681	5,568	4,617	4,331	$_{4,455}^{m}$	5,614	6,862	6,954	10,528
	N.S.W.	2 <b>0</b> ,370	1.292	1.350	1.232	.967	.884	.804	.685	.579	.830	.930	1.062	1,385
33		14,180	1,527	1,595	1,456	1,142	1,045	949	809	$\frac{m}{684}$	981	1,100	1,255	1,637
1436533	Vict.	45,69 <b>0</b>	1.283	1.310	1.135	.978	.828	.609	.519	.608	.796	1.077	1.093	1.763
1		31,806	3,400	3,476	3,007	2,592	2,195	1,615	$^{m}_{1,375}$	1,612	2,110	2,852	2,898	4,674
$\overline{P}$	Q'land.	531	1.08	.79	1.22	.93	1.45	1.22	.68	.86	.77	1.02	.95	1 04
.ei ∖		370	33	24	38	28	45	38	m 21	26	24	31	29	32
tral	S. Aust.	47,205	1,088	1.182	1.096	1.050	.833	729	.775	.776	.913	1.032	1.012	1.514
Aus		<b>32,86</b> 0	2,980	3,236	3,000	2,877	2,281	1,996	2,122	2,125	2,499	2,827	2,772	4,145
≱	N. Terr,	266	0.0	1.17	0.0	.267	.13	1.22	27	.45	0.0	3.39	.00	2.71
From W. Australia		185	0	18		41	2	26	4	7	• •	52	••	42
<b>#</b>	Total	114,062	1.200	1.262	1.134	1.010	.841	.698	.655	.673	.848	1.037	1.051	1.591
		79,401	7,941	8,348	7,501	6,681	5,568	4,617	$_{4,331}^m$	4,455	5,614	6,862	.	10,528
						<u> </u>	<u> </u>				<u> </u>	- 1		

TABLE CLXII.—Shewing the Fluctuations for "Persons" in the Interstate Migration by Sea in Australia for the Period 1909-13—continued.

			FLUC	TUATION	RATIO	(Total	L'= 12.0	000) AN	d Migr.	ATION-B	ATIOS F	OR PER	SONS.	
	State.	Mi- grants.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
æi ∫	N.S.W.	37,786	1.566	1.474	1.482	1.442	1.018	1.044	.825	.553	.735	.520	.613	.728
959218.		3,939	5,140	4,837	4,865	4,735	3,343	3,427	2,708	1,815	2,411	1,709	2,013	2,388
8	Vict.	168,563	1.606	1.619	1.432	1.223	.821	.686	.693	$_{m}^{.680}$	.709	.876	784	.871
Ъ		17,572	23,512	23,700	20,970	17,911	12,014	10,053	10,149	9,952	10,389	12,831	11,485	12,756
ig	S. Aus.	339	.57	.67	4.01	3.33	.81	.78	0.0	$_{m}^{.07}$	.28	.71	.60	.17
Tasmania		<b>35</b>	17	20	118	98	24	23		2	8	21	18	5
	W. Aust.	158	0.0	.46	3.49	6.68	1.06	.31	•••				••	••
From		16	0	6	48	92	15	4		••		•••		••
Ħ	Total	206,846	1.595	1.590	1,447	1.271	.857	.752	.715	.655	.713	.810	.752	.843
		21,564	28,669	28,563	26,001	22,839	15,396	13,506	1 2,857	11,768	12,809	14,560	13,516	15 <b>,15</b> 0
-	N.S.W.	412	.87	.64	.61	.58	.75	1,11	.93		1.72	1.81	1.49	1.08
10338.		39,800	2,900	2,100	2,000	1,900	2,500	3,700	3,100	1,300	5,700	6,000	4,900	3,600
10	Vict.	210	.57	1.66	1.37	.51	.40	.40	.57	.91	.80	1.49	1.26	2.0€
ď		20,300	9,700	2,800	2,300	8,700		6,800	9,700	1,500	1,300	2,500	2,100	3,500
٠,	Q'land.	387	.75	.53	.44	.84	1.02	.93	1.19	1.39	.65	1.77	1.24	1.33
Territory.		37,400	2,300	1,600	1,300	2,600	3,200	2,900	3,500	4,400	2,000	5,500	3,900	4,200
Теп	W. Aust.	161	. 0.0	1.57	0.0	1.49	1.49	.75	1.12	.30	.37	2.01	.52	2.3
Ä.		15,600	C	2,000	(	1,900	1,900	9,700	1,400		4,800	2,600	6,800	3,100
From	\ Total	1,170	.66	.91	.61	1 .78	.88	.87	.95	.8.	1.02	1.76	1.23	3 1.5
Ξ.		113,200	6,200	8,600	$\frac{m}{5,700}$	7,400	8,300	8,200	9,000	7,600	9,600	1,600	1,200	1,40

The upper figures are the relative average magnitudes of the migration for the month, the monthly average for the year being unity. Those underlined are the maximum-values and those marked "m" the minimum values during the year.

The small figures are the number of migrants ("persons") per 1,000,000 population in the State from which the migration takes place.

That Land Migration also shows marked periodicity is evident from Table CLXIII. It is worthy of notice that the total immigration for a year is sensibly equal to the total emigration for the same period, though the want of balance for individual months may be considerable.

TABLE CLXIII.—Shewing the Periodic Fluctuation of Overland Migration (by Railway) for equalised months and a Constant Population.

Australia, 1914-1916. ("Persons.")

	ARE	RIVALS OR	[mmigratio	ON.	DEF	ARTURES	OR EMIGRA	TION.
Month.	N.S.W.	Vic.	Q'land.	S. Aust.	N.S.W.	Vic.	Q'land.	S. Aust.
January February March April May June July August September October November December	1.1517 .3824 1.1093 1.2085 .9584 .8034m .8389 .8734 .9394 .8700 .9091 1.3549M	1.0855 .9812 .9427 1.1153 .9353 .8360 .8269 m .8985 1.0494 1.1441 .9884 1.1967 M	1.5297M 1.0387 1.2059 1.3487 1.0189 .7474 .7472 .8454 .7266 .7610 .7117 m 1.3188	1.1928 .9737 .9944 1.1649 .9761 .8007 m .8528 .9445 .9602 .9047 .9350 1.3002 M	1.2452 1.0044 1.0339 1.1811 .9438 .7888 m .7999 .8938 .9432 1.0000 .8809 1.2790 M	1.0973 .9437 1.0848 1,1745M .9928 .8533 m .8921 .9179 1.0177 .9115 .9970 1,1174	1.2142 .9738 1.1270 1.2167 .8907 .7072 .6995 m .8231 .8349 .8703 .8219 1.8207 M	1.2352 1.0580 1.0250 1.2827M 1.0278 .8643 .8904 .8488 m .8892 .8770 .8725 1.1091
Mean No. for equalised mnth. Aggr. Popn	67,102	48,188	24,278	18,063	67,007	47,804	24,516	18,244

M denotes the maximum and m minimum value.

- 7. Migration and Age.—If the ages of migrants of each sex are recorded at the moment of entry into or exit from any community, it is possible to know continuously the constitution of the population according to sex and age, once a population Census has been taken. Results forwarded to the compiling authority only at long intervals require corrections, of the type referred to in Part XI., §§ 7-9, pp. 152-160. The deduction of ages is best effectuated by referring all the results to the one point of time, say the end of the calendar year.
- 8. Defects in migration records and the closure of results.—Notwithstanding that elaborate care was taken as regards the record of emigration, it has been found in Australia that errors occur therein of considerable magnitude. From the 1901 Census and the intercensal records up to the Census of 1911, it appeared that, if the discrepancy were attributed wholly to this source of error, it would amount, in the case of males, to 0.1459 of the whole recorded male migrants outward (departures) and in the case of females to 0.0995 of the whole recorded female migrants outward. A still more extraordinary result was that apparently the island-continent of Australia was rapidly losing females. <sup>1</sup>

Suppose that a statistical element  $E_0$  is accurately ascertained at any point of time (e.g., as at a Census) and after n years is again accurately ascertained and found to be  $E_n$ ; and further that the intervening changes are  $e_1, e_2, \ldots e_n$ . Then:—

(661).. 
$$E_n = E_0 + k (e_1 + e_2 + \dots + e_n)$$
; or  $k = (E_n - E_0)/(e_1 + e_2 + \dots + e_n)$ 

The quantity k may be called the coefficient of proportional linear adjustment, and  $E_1$ ,  $E_2$ , etc., may be found by the successive additions, viz., of  $ke_1$ ,  $ke_2$ , etc., instead of the unadjusted change. We may, however, correct the results as indicated in (662), that is:—

(662).. 
$$E_n = E_0 + e_1 + e_2 + ... + e_n + \epsilon = E_0 + (e_1 + \kappa) + (e_3 + \kappa) + ... + (e_n + \kappa).$$

in which last expression  $\kappa = \epsilon/n$ , the total defect of closure,  $\epsilon$ , being divided equally among the changes. Thus in this case  $E_1$ ,  $E_2$ , etc., may be found by successive additions, viz., of  $e_1 + \kappa$ ,  $e_2 + \kappa$ , etc. This may be called *simple linear adjustment*. The question as to whether one or the other or either is legitimate, must always be decided by the nature of the case, and obviously no general rule can apply.

<sup>&</sup>lt;sup>1</sup> Upon a change being made on the system as between State and State, such that the aggregate of the State-increments of population gave the increment of population to the Commonwealth, this peculiarity vanished.

## XVII.—MISCELLANEOUS.

- 1. **General.**—It is proposed in this part to refer to a number of miscellaneous matters, which have not been included in previous parts, and which either do not fall under any particular heading, or have been omitted from earlier consideration.
- 2 Subdivision of population and other groups.—The values of group-subdivisions, which are obtained by dividing groups by the middle ordinate, are given earlier, see Part VI., § 4, pp. 80-81. These formulæ are not always applicable. Two questions often arise, viz. (i.) the value of the subdivisions or (ii.) of their ratios to each other.

Considering first the subdivision of a group g into two parts, let it be supposed that the function, representing a series of groups, viz.,  $g_{-4}, \ldots g_{-1}, g, g_1 \ldots g_4$ , is  $a+bx+cx^2+$  etc., then we shall have<sup>1</sup>:—

$$\begin{array}{l} (663).....\\ g_{-\frac{1}{2}} = \frac{1}{2}g \, - \frac{1}{256} \left[ 61(g_1 - g_{-1}) - 44(g_2 - g_{-2}) + \, 19(g_3 - g_{-3}) - \, 3\frac{1}{2}(g_4 - g_{-4}) + \text{etc.} \right] \end{array}$$

 $g_{-\frac{1}{2}}$  denoting the portion of the group g on the negative side of the middle ordinate of that group. This formula is in general suitable about maxima and minima values, but may, of course, be inappropriate if  $g_k - g_{-k}$  increase more rapidly than the coefficients diminish. It may often be employed, however, when pairs of terms in the square brackets are sharply convergent.

Another process of arriving at values for the subdivision of groups into halves is the following:—Let the values of the successive groups be C, B, A, M, A', B' and C', and M, the group to be divided. Then the portion next to A is  $^2$ :—

(664)...
$$M' = \frac{1}{2}M - \frac{1}{2048} [201(A'-A) - 44(B'-B) + 5(C'-C) - ...]$$

which in many cases gives substantially the same result as (663), though it is not an identical formula, and apparently might be regarded as not in agreement therewith.

 $<sup>^1</sup>$  This is deduced by finding, in terms of the groups themselves, the values of the constants  $a,\,b$ , etc., of the curve: and then integrating between the limits which give the first half of the group to be subdivided.

<sup>&</sup>lt;sup>2</sup> This is easily derived from the usual formula for interpolation into the middle, viz.,  $F(t) = F + \frac{1}{2} a' - \frac{1}{8} b_0 + \frac{3}{128} d_0 - \frac{1}{1024} f_0 + \text{etc.}$ , by regarding the aggregates C, C+B, C+B+A, C+B+A+M, etc., as successive totals represented by ordinates represented by  $a + \beta x + \gamma x^2 + \text{etc.}$ ; finding the value to the middle ordinate of group M and subtracting C+B+A.

In the case of groups rapidly increasing or rapidly diminishing in amount—as for example the numbers dying at the beginning of life in 0–1, 1 to 2, etc., days, weeks, months or years, the following method of subdivision may be followed:—

Let it be required to divide each of a series of larger groups A, B, C, etc., for equal limits of a variable into s smaller groups, viz.,  $a_1, a_2, \ldots$   $a_s$ ;  $b_1, \ldots b_s$ ;  $c_1, \ldots c_s$ ; etc., and suppose that B=mA; C=m'B=mm'A; etc. Then if m'=m, etc., it is obvious that the successive values of the smaller groups will be:—

$$(665)..(a_1 + na_1 + n^2a_1 + ...) + (b_1 + nb_1 + n^2b_1 + ...) + \text{etc.} = (a_1 + ... + n^{s-1}a_1) + (n^sa_1 + ... + n^{2s-1}a_1) + (n^{2s}a_1 + ... + n^{3s-1}a_1)$$

in which n is the sth root of m and m'. The brackets shew the groups, the sum of which give the original values A, B, C, etc. Since from each of any three adjoining groups an equal quantity Q may be cut off or added, so that the altered values A', B', C' will be A',  $m_0$  A',  $m_0^2$  A', we can constitute the group-divisions by adding a common value Q/s to each of a series of quantities of the type of (665) above,  $n_0$  in this case being the sth root of  $m_0$ . Hence we have:—

$$(666).....a (1 + n + n2 + ... ns-1) = A' = A - Q;$$

from which, since n is known, a can consequently be determined, and the series a, na,  $n^2a$ , etc., to which, if a common quantity q=Q/s is added we obtain  $a_1$ ,  $a_2$ , etc. Thus:—

$$(667).....a_1 = A'/(1+n+n^2+...+n^{s-1})+q = a+q$$
;  $a_2 = na+q$ ;  $a_3 = n^2a+q$ ; etc.

In applying this method practically, any group may be subdivided by treating it as B, and dividing it according to the indications of the groups on either side A and C.

3. The measure of precision in statistical results.—Statistical results, expressed without regard to their possible or probable error, often suggest the attainment of a precision far beyond that which the data can furnish. For example, if the ratio of the survivors after one year be given (as in life-tables) to 5 decimals, the results *imply* for Australian data an average precision of age for the first year of 1.1 hour, or at its terminal of 0.4 hour. For other countries it will be much the same. Again, in the case of the instantaneous rate of mortality at the end of the first year, the expression to 5 places of decimals *implies* a precision, in the time or epoch to which it may be deemed to apply, of 8 days. In both cases the apparent precision is illusory, <sup>1</sup> forasmuch as the recording of the facts and their actual

<sup>&</sup>lt;sup>1</sup> See Census Report, Vol. III., p. 1215, and also p. 1212.

variableness does not conform to this order of precision. For example, births and deaths are not recorded as regards age to 0.4 hour per annum even on the average: nor can the point of time to which they may appropriately be referred be deemed to be ascertained to 8 days or its equivalent in a decade. Actuarial tables are often carried to 7 places of decimals. A unit in the last place is (on the average) for ages 1 to 2 about equivalent to an age-difference of 2 minutes, and, owing to the diminution of death-rate with the lapse of time, also to about the same as to the point of time to which the result is presumed to apply.

Let u and y denote respectively functions of time (t) and of age (x), then if:—

$$(668)...\Delta u = Idt$$
;  $\Delta y = J\Delta x$ ; or  $I = du/dt$ ;  $J = dy/dx$ 

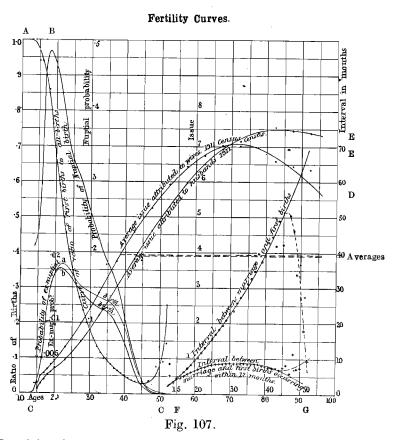
in the limit, I and J are the ratios of relative importance—as compared with the units of u and y—of precision in the units respectively of t and x. These ratios serve as guides in fixing the relative accuracy required in the data giving the two co-ordinates. If in graphing results, the units on the axis of abscissæ are, respectively, I and J times the units on the axis of ordinates, then the curve will make an angle of  $45^{\circ}$  with either axis, and this, in so far as it is practicable to follow it, is the best scale-relation between ordinate and abscissa for any graph intended to be used for analysis.

The life-tables published in connection with the Australian Census of 3rd April, 1911, follow the usual tradition as regards the number of figures to which the results are expressed. It is not, however, implied that the precision indicated is realised, they merely are followed for the sake of consistency in the results.

By suitable combinations of arithmetical and graphical methods results can be obtained to any required degree of practical precision. <sup>1</sup>

4. Indirect relations.—It is often necessary to establish statistical relations which really depend upon some intermediary statistical relation. For example, the average number of children born to an individual, or "average issue" may be related to age of "mothers," and such a relation would, of course, be a direct one. For certain purposes, however, (e.g., social insurance) the average issue may be required as related to the age of fathers. The later relation, though physically indirect, is a regular and important one. Nevertheless, it is one which may be deduced by means of certain data from direct relations; at the same time it is not preferable to obtain it in this way. The relations according to "wives" and "husbands" are both given immediately by the Census, and the relation so given is, in general, to be preferred to the deduced relation: see Fig. 107.

<sup>&</sup>lt;sup>1</sup> If the value of I or J is not between the limits  $\frac{1}{4}$  to 4, the natural scale for both co-ordinates is not ordinarily satisfactory in graphing a function; however, the mode of variation of the greater co-ordinates will assist in the determination of a truly smoothed curve.



Curve A shews the ratio, according to age, of first births to all births.

Curve B shews the probability, according to age, of a nuptial birth; see also p. 242 and p. 243.

Curve Ca shews the probability, according to age, of an ex-nuptial birth on the assumption
(i.) that they are attributable wholly to the never-married.

Curve Cb shews the probability, according to age, of an ex-nuptial birth on the assumption (ii.) that they are attributable equally to the never-married, widowed, and divorced.

Curve Cb shews the average issue, according to age, of wives at the Census of 1911.

Curve E shews the average issue, according to age, as related to husbands at the Census of 1911.

Curve FC shews the average interval, according to age, between marriage and first-births.

Curve FG shews the average interval, according to age, between marriage and first-births, occurring within 1 year of marriage.

5. Limits of uncertainty.—The limits of an uncertainty in any deduced quantity may be due to possible errors in the numbers upon which it is founded, or upon an uncertainty as to the particular quantity which should be employed. The first cause of uncertainty is sufficiently illustrated by the ratio of, say, first births to all births: for prediction purposes the smoothed numbers in Table CLXIV. are really more probable than the crude numbers: see Fig. 107.

The second cause of uncertainty is illustrated in the following example:—If the "never married," the "widowed" and the "divorced" are regarded as a homogeneous class, the probability of a case of ex-nuptial maternity during one year is found by dividing the number of births in one year by the sum of the average numbers in the three

classes. If, however, they are not homogeneous as regards this probability, a more accurate result might be obtained by dividing by the never married. The general probability must lie between the two results: see the curves marked Ca and Cb on Fig 107, and the results in columns marked I. and II. respectively in Table CLXIV.

It may be noted that the characteristics of a variation may be wholly changed by restriction within limits. This is seen by taking the interval according to age between marriage and a first birth, when the consideration is restricted to the lapse of 12 months, or is indefinite: see the curves FG and FE' respectively.

TABLE CLXIV.—Shewing Rates of First to All Births, and Probabilities of Ex-nuptial Maternity. Australia, 1907-14.

Age.	Ratio c	of First Births.	Probabili nuptial M based assum	Age.		Ratio o		Probability Ex- nuptial Maternity based on assumption		
	Crude.	Smooth- ed.	I	11.			Crude.	Smooth- ed.	I.	II.
12 13 14 15 16 17 18 19 20 21 22 23 24 25 28 28 29 30 31 33 33 33 34 34 34	1.0000 1.0000 9404 9407 9130 8602 7627 6594 5912 5285 4534 3360 3482 2722 2352 1187 1800 1555 1324	1.0000 .9970 .9930 .9715 .9430 .9035 .8450 .7627 .66,4 .5912 .1170 .4485 .3960 .2710 .2265 .1795 .1560 .1355 .1182	.000015 .000062 .00037 .0016 .0042 .0085 .0131 .0157 .0172 .0180 .0181 .0176 .0169 .0169 .0144 .0143 .0149 .0143 .0147 .0135 .0135	.000015 .000062 .00037 .0015 .0042 .0085 .0131 .0162 .0173 .0179 .0174 .0161 .0174 .0147 .0147 .0147 .0135 .0130 .0123 .0123 .0123	34 35 36 37 38 39 40 41 42 43 44 45 47 48 49 55 55 55		.0994 .0923 .0817 .0703 .0640 .0583 .0524 .0437 .0381 .0349 .0244 .0360 .0255 .0769 .1333 .0909 .1429	.1040 .0920 .0825 .0730 .0640 .0560 .0485 .0370 .0338 .0310 .0285 .0295 .0395 .0398 .0428 .0500 .0285 .0790 .0285 .0790 .0285 .0790 .0285 .0790 .0285 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790 .0790	.01325 .0130 .0127 .0122 .0115 .0095 .0076 .0059 .0030 .0020 .0012 .00085 .00055 .00055 .00022 .00012 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .00020 .0002	.0118 .0115 .0110 .0103 .0094 .0084 .0072 .0058 .0044 .0030 .0018 .0008 .0008 .0009 .00000 .00000

I. denotes the ratio of births to the never-married; II., the ratio of births to the aggregate of the never-married, widowed and divorced.

6. [The theory of "happenings" or "occurrence frequencies."—In order to establish a rational theory of, and to completely interpret, the frequency curves met with in the various elements of the statistics of population, a theory of the frequency of occurrences of various kinds is a first requisite, and the type-forms of distribution established by Prof. K. Pearson and his co-workers are a contribution thereto, based upon the application of the theory of probability, plus certain empirical assumptions by means of which assymetrical forms of various kinds are deduced. Recently a foundation has been laid of a perfectly general theory of the frequency of occurrences, by Prof. Sir Ronald Ross. This latter seems to have had its birth in an attempt made in 1866 by Dr. Farr to develop a definite theory of an epidemic (cattle plague)<sup>1</sup>. In 1873-5 Dr. G. H.

<sup>&</sup>lt;sup>1</sup> Dr. William Farr, "On the Cattle Plague," Journ. Soc. Sci., 20th Mar., 1866.

Evans endeavoured to extend Farr's theory to other epidemics.<sup>1</sup> The subject was again reopened by Dr. J. Brownlee<sup>2</sup> in a series of very significant contributions, and later, by Ross. Quite recently the lastnamed has put forward a definite theory, the fundamental elements of which are outlined in this section.<sup>3</sup> Although the main object was initially the determination of a basis for a theory of epidemics, the results are entirely general, and may be called the theory of "occurrences" or "happenings."

The differential equation of independent occurrences, reduced to its simplest expression, may be deduced as follows:—

Suppose a population P to consist of two parts, viz., A a part which is unaffected, and Q a part which is affected, by any "happening," so that P = A + Q. Suppose also that some portion, viz., hdt, of the unaffected part becomes affected in the time dt, and also that a portion rdt of the affected part reverts to the unaffected part in the same element of time, so that the element of increase of the affected part is (h-r) dt; and finally let bdt, mdt, idt and edt denote in the unaffected part, the rates of birth, death (or mortality), immigration and emigration respectively; and Bdt, Mdt, Idt and Edt denote the similar rates in the affected part. Obviously therefore:—

$$(669)..dP = A (b-m+i-e)dt + Q(B-M+I-E)dt = (Av+QV)dt;$$

$$(670)..dA = A(b-m+i-e-h)dt + Q(B+r)dt = \{A(v-h)+Q(B+r)\}dt;$$

$$(671)..dQ = Ahdt + Q(-M+I-E-r)dt = \{Ah+Q(V-B-r)\}dt;$$

<sup>&</sup>lt;sup>1</sup> Dr. G. H. Evans, "Some arithmetical considerations on the progress of epidemics," Trans. Epidemiol. Soc. London, Vol. 3, Pt. III., p. 551, 1873-5.

<sup>&</sup>lt;sup>2</sup> Dr. J. Brownlee (i.) Theory of an Epidemic," Proc. Roy. Soc. Edin., Vol. 26, Pt. IV., p. 484, 1906; (ii.) "Certain considerations on the causation and course of epidemics," Proc. Roy. Soc. Med., Lond., June 1909; (iii.) "The mathematical theory of random migration and epidemic distribution," Proc. Roy. Soc., Edin., Vol. 31, Pt. II., p. 261, 1910; (iv.) "Periodicity in infectious disease," Proc. Roy. Phil. Soc., Glasgow, 1914; (v.) "Investigations into the theory of infectious diseases, etc., Public Health, Lond., Vol. 28, No. 6, 1915; (vi.) "On the curve of the epidemic," Brit. Med. Journ., May 8, 1915.

<sup>&</sup>lt;sup>3</sup> Lieut.-Col. Prof. Sir Ronald Ross. (i.) "The logical basis of the sanitary policy of mosquito reduction." Cong. Arts and Sci., St. Louis, U.S.A., Vol. 6, p. 89, 1904, and Brit. Med. Journ., May 13, 1905; (ii.) The prevention of malaria in Mauritius," Waterlow and Sons, Lond., 1908, p. 29-40; (iii.) The prevention of malaria, J. Murray, Lond., 1910; 2nd Edit., 1911; Addendum on "the theory of happenings," 1911; (iv.) Some quantitative studies in epidemiology, Nature, Lond., Oct. 5, 1911; (v.) "Some a priori pathometric equations," Brit. Med. Journ., Mar. 27, 1915; (vi.) "An application of the theory of probabilities to the study of a priori pathometry"; Proc. Roy. Soc., Lond., Vol. 92, ser. A., July 14, 1915, pp. 204-230. See also H. Waite, "Mosquitoes and Malaria," Biometrika, Lond., Oct. 1910, Vol. 7, No. 4, p. 421.

<sup>&</sup>lt;sup>4</sup> The affection may be of any nature, such as a disease, etc., and the supposition is quite general.

 $<sup>^5</sup>$  The "happening" is the becoming affected, and is equally general with the preceding supposition.

and writing v and V for the algebraic sum of the quantities in the brackets in (669), the final forms of the preceding equations are given as is necessary of course, dP = dA + dQ. It may be noted that only aA and dQ contain terms representing the happening (h) and reverting elements (r), and that QBdt appears in (670) but not in (671), because, in general at least, the progeny of the affected part are not affected at the instant of birth. Although the variation elements b, m, i, e and B, M, I, E will, if long periods are constant when short periods only are under review. Consequently for elementary cases mean values may be taken without sensible error, <sup>1</sup> similarly in regard to the reverting element.<sup>2</sup>

The most important element is the happening element, h, which it is to be clearly understood ordinarily falls on both groups (A and Q) alike. Should, however, it fall upon individuals already affected, it merely reaffects them and does not cause them to pass from one group to the other. Hence, though the total number of "happenings" is P.hdt = (A+Q)hdt, the number Qhdt are already affected and must not be taken account of. The actual number of new cases Gdt, say, is thus only Ahdt. Thus:—

(672)...... 
$$Gdt/Phdt = \frac{A}{P}$$
; or  $G = hA = h(P - Q)$ 

"Happenings" may be divided into two classes, viz. :—(a) those in which the frequency of the happening is *independent* of—and (b) those on which is *dependent* upon—the number of individuals already affected.<sup>3</sup> In independent happenings h and G are constants, in dependent happenings they are functions of Q.

<sup>&</sup>lt;sup>1</sup> If, as is often the case, the "happenings" have no effect on the birth, death and migration rates, then we may have b=B, m=M, i=I, e=E, and consequently v=V, which may also occur fortuitously though the several terms differ. In general b is less than B in marriages, m than M in accidents, while in certain alarming epidemics (e.g., cholera, plague, malaria) i is greater than I, and e less than E, in which case v is greater than V. In fatal accidents M=1, and B, I and E are all 0, which value may also be assigned when considering happening among the same individuals. If a surrounding population be not affected I=0; if affected individuals cannot move E=0.

<sup>&</sup>lt;sup>2</sup> In the case of "independent happenings"—see later, rdt denotes merely the proportion of affected individuals who may become reaffected in the time dt. (e.g., by divorce in marriage). In "dependent happenings" it implies loss of capacity for affecting others (e.g., in infectious disease it implies both immunity and loss of infectivity). In some diseases r may be zero (e.g., leprosy and organic diseases, fatal accidents); it may be of small value (e.g., many zymotic diseases); it may be of high value (e.g., snake-bite, heat-stroke, etc.), and it may be unity (e.g., slight accidents).

<sup>&</sup>lt;sup>8</sup> To the former belong cases which are attributable to what may be called external causes (e.g., accidents, non-infectious diseases, etc.); to the latter belong all cases attributable to propagation from individual to individual (e.g., infectious diseases, etc.),

In independent happenings, therefore, the happening falls upon the same proportion (hdt) of the population in every element of time. Put x=Q/P and P-Q for A, then equations (669) and (671) give :—

$$(673)....dP/dt = vP - (v - V) xP$$

$$(674)...d (xP)/dt = hP (1-x) + (V-B-r) xP$$

and by differentiation:-

$$(675)....d(xP)/dt = xdP/dt + Pdx/dt.$$

From these three last equations, we have after dividing by P, and eliminating d (xP)/dt and dP/dt:—

$$(676).....dx/dt = h - (h + v - V + B + r) x + (v - V) x^{2}$$

which gives one form of integral if v-V=0, and a different one if v and V are unequal.

When the sum of the variation elements of the affected group is constant the case may be called the *equivariant case*, the total population is unaltered.<sup>1</sup> Putting:—

$$(677)...K = h + B + r; L = h/K; y = L - x;$$
 hence

$$(678)...dx/dt = -dy/dt = K(L-x) = Ky; dy/y = -Kdt;$$

which gives on integrating:-

(679).....log 
$$y = -Kt + C$$
, or  $y = y_0 e^{-Kt}$ ,

 $y_0$  being the value of y at the beginning of the "happening." Consequently, since  $y_0 = L - x_0$ :—

$$(680)....x = L - (L - x_0) e^{-Kt}$$

viz., the proportion of the total population affected at the time t, the proportion being  $x_0$  when t=0.2

When v is not equal to V, we have the general case of independent happenings which involves the integration of (676). This may be written in the form:—

$$(681)...dx/dt = K(L-x)L'-x) \equiv K(\alpha-\beta-x)(\alpha+\beta-x)$$

<sup>&</sup>lt;sup>1</sup> An example would be the occurrence of slight accidents in which case r=1, or the attainment of a certain standard of wealth tending to diminish simultaneously the birth, death, and migration rates of the affected by an equal decrement. If the progeny of the affected are also affected B should be omitted from (670), and inserted in (671), and will disappear in (674) and (676).

<sup>&</sup>lt;sup>2</sup> Obviously in (673) if v-V=0, a differential equation of the same form as (678) is obtained, hence  $P=P_0e^{vt}$ , formula (2), p. 10 herein.

in which a=(h+B+r+K)/2K and  $\beta=\sqrt{(a^2-h/K)}$ , the roots  $L=a-\beta$  and  $L'=a+\beta$ , being always real and positive when v>V. This gives :—

(682)...
$$x = L - (L' - L) (L - x_0) / \{(L' - x_0) e^{2K\beta t} - (L - x_0)\}$$

which simplifies slightly if  $x_0=0$ . The relative number of the affected depends upon whether K, that is whether v-V is positive or negative, the former being usually the case in injurious happenings and the latter the case in beneficial ones. This gives:—

(683)..
$$P = P_0 e^{vt}$$
.  $Le^{-KLt}/(L'-L)$ ; or  $P_0 e^{vt}$ .  $-Le^{-KL't}/(L'-L)$ 

the former expression being appropriate when K is positive, the latter when it is negative.

Among dependent happenings the case of proportional happenings is important as a first approximation to the study of the infection of a community. In this instance h is a function of Q and consequently of t. If each affected individual affects c others in a unit of time the total happenings in the time dt will be cQdt. The number of new cases per element of time may be taken as probably:—

$$(684).....Gdt/cQdt = A/P$$
; or  $G = cQ(1-x)$ ;  $h = cx$ .

This gives :---

(685). 
$$dx/dt = Kx(L-x)$$
, in which  $K=c-v+V$ ;  $L=1-(B+r)/K$ , from which may be obtained:—

(686)....
$$x = L/\{1 + (L/x_0 - 1)e^{-KLt}\}.$$

This gives regular bell-shaped curves:  $x_0$  and  $Q_0$  can never be zero.

Sufficient has been indicated to shew the value and reach of Prof. Ross's analysis of the question, and to render evident the fact that it is the foundation of a rational theory of "occurrences" of any kind, which can be numerically defined, in a population.

7. Actual statistical curves do not coincide with elementary type forms.—The importance of a rational theory of "happenings" does not consist in the fact that the curves deduced from elementary suppositions, meticulously correspond to actual statistical frequencies, but in the fact that deduced types give the general configuration. Since in actual cases what may be called the frequency of initiation is variable, the deduced forms of frequency at any given moment are only partially applicable to actual cases. Moreover any assymetrical and polymorphic curve, and indeed even any regular curve, can be built up in an infinite number of ways. The dissection of a curve into additive components is therefore,

in general, purely empirical. Although this is so, when extra-mathematical reasons exist for the acceptance of an hypothesis of constituent elements, whose origins, and general characters, are known, it may be possible to effect an analysis into components which yields a real and not merely a formal interpretation. <sup>1</sup>

In general, type-curves, the interpretation of which is impossible and is ignored outside certain selected points (e.g., the points where they meet the axis of abscissæ) are logically unsatisfactory.

The function of a "theory of happenings" and of the "theory of probability," is therefore one of guidance in interpretation, and of deciding as to the applicability or otherwise of particular types of mathematical expression for the representation of the change of frequency with change of the variable. Mere arithmetical tests of the "goodness of fit" of particular mathematical expressions are significant or otherwise according as they conform to what is known a priori, or is deducible from a priori considerations, and these must certainly be taken in conjunction with the observations over the whole range of experience. <sup>2</sup>

8. International norm-graphs and type-curves. — The function served by the creation of norms has been indicated in Part VIII., § 6, p. 102. When norms for every important population-character have been computed, it is desirable that they should be graphed and used internationally. This could be done by printing squared graphed paper, with the norm shewn thereon, say in pale colour (or by a very fine line). The graphing of the same character on such paper for any particular population, would then immediately disclose the nature of its deviation from the normal. In this way the population phenomena could be graphically studied in their comparative relationships.

An extension of the system would be for each country to shew by pale tint not only the international norm, but also its own norm for (say) the previous decade.

Type-curves for international use would also greatly assist in the work of a better technical reduction of statistical results. The forms desirable or necessary would doubtless be more readily recognised when the international norms had been obtained.

<sup>&</sup>lt;sup>1</sup> For example in the harmonic analysis of tides, the forms and periods of the components are determined by celestial positions (*i.e.*, of the sun, moon, "anti-sun," anti-moon," etc.), and the elements to be ascertained are merely the epoch of each component and its amplitude.

<sup>&</sup>lt;sup>2</sup> For example, to systematically vary the representation of facts in order to agree with some adopted mathematical expression to which it is thought they ought to conform, is only to delude oneself. The character of terminal conditions is often known a priori, and the mathematical expression representing the facts should not be merely one in substantial arithmetical agreement with the frequency, but one which expresses as accurately as may be the law of its change. Similarly, the adoption of an expression which disturbs the observed critical values of the frequency, vitiates the results.

9. Derivative elements from population-theory.—It is beyond the purpose of this monograph to discuss the various derivative branches of the theory of population; such, for example, as the estimation from probate-records of the aggregate of private wealth; of the economic value of an average man or woman; of the economic value of different classes of persons; the cost of, and economic value of, education, etc. The present increasing length of life tends to give a higher average economic value—other things being equal—to an individual: the average wealth possessed per individual is probably also increasing.

Although all that relates to population may, in a comprehensive view, be regarded as belonging to its theory, it is quite appropriate that purely economic questions should be separated out. Therefore, while results obtained by means of the development of the population-theory are essential and are of the first order of importance, in any attempt, for example, to reach decisions as to the economic aspects of population, the questions that arise are so extensive that they must be treated independently. Nevertheless, the value of a suitably developed theory of population is not seen until it is viewed in the light of all its applications among which the economic is but one.

Similar observations apply to the anthropometric elements of the population. These are probably correlated with elements treated hereinbefore; nevertheless, it is preferable to deal with them independently.

10. Tables for facilitating statistical computations.—Mathematical tables of various kinds have been prepared for facilitating statistical computations, among which may be specially mentioned "Tables for Statisticians and Biometricians," by Prof. Karl Pearson, F.R.S., etc. In this monograph the following tables are solely for facilitating the computation or illustrating the mode of deducing quantities which enable required quantities to be found by inspection:—

 Tables
 I. VI. XVII. & XVIII. XXXVII. & XXXVII. XL. LXV. LXVI.

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11. Statistical integrations and general formulae.—Reference has already been made in Part VI., §§ 6-8, pp. 82-84, to statistical integrations, and references were given to various tables, see p. 82. The integration of functions of a single variable is the subject of one of the Cambridge Tracts in Mathematics and Mathematical Physics, No. 2. This and the works previously mentioned will enable most integrations occurring in practical cases to be effected. For convenience the following are given:—

### Table of Integrals and Limits.

```
\int dx = x - 2\arctan\sqrt{(\frac{1-\cos x}{1+\cos x})}; \quad \int (ax \pm b) \ dx = \frac{1}{2}(ax^2 \pm 2bx) = \frac{1}{2a}(ax \pm b)^2; \ C = \frac{b^2}{2a};
         \int \frac{dx}{x} = \log x = \log \left(\frac{x}{a} + \frac{x}{b}\right) : \int \frac{dx}{ax \pm b} = \frac{1}{a} \log \left(ax \pm b\right) : \int \frac{mx + n}{ax + b} dx = \frac{m}{a}x + \frac{an - bm}{a^2} \log \left(ax + b\right) :
\int\!\!\!\frac{dx}{ax^2+bx} = \frac{1}{b}\log\frac{x}{ax+b} : \int\!\!\!\frac{dx}{(x+a)(x+b)} = \frac{1}{b-a}\log\frac{x+a}{x+b} : \int\!\!\frac{dx}{ax^2+bx+c} = \int\!\!\frac{dx}{\varphi}, \text{ put } \beta = b^2 - 4ac,
   then \int \frac{dx}{\phi} = \frac{1}{\sqrt{\beta}} \log \frac{2ax + b - \sqrt{\beta}}{2ax + b + \sqrt{\beta}} = \frac{2}{\sqrt{\beta}} \log \frac{2ax + b - \sqrt{\beta}}{\sqrt{\phi}} = \frac{2}{\sqrt{-\beta}} \arctan \frac{2ax + b}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} \arcsin \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} \arctan \frac{(2ax + b)\sqrt{-\beta}}{2a\phi} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} = \frac{1}{\sqrt{-\beta}} - \frac{1}{\sqrt{-\beta}} =
                                   = \frac{2}{\sqrt{-\beta}} arc sin \frac{2ax+b}{2\sqrt{(a\phi)}}, = \frac{2}{2ax+b} when \beta = 0: \int \frac{xdx}{ax^2+bx+c} = \int \frac{xdx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{1}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}{\phi} = \frac{a}{2a}\log\phi - \frac{b}{2a}\int \frac{dx}
                             = \frac{1}{2a} \log \phi - \frac{b}{2a\sqrt{\beta}} \log \frac{2ax + b - \sqrt{\beta}}{2ax + b + \sqrt{\beta}} = \frac{1}{2a} \log \phi - \frac{b}{a\sqrt{\beta}} \arctan \frac{2ax + b}{\sqrt{-\beta}} = \frac{b}{a(2ax + b)} + \frac{1}{a} \log(2ax + b)
                                \int \frac{mx^2 + nx + P}{ax + b} dx = \frac{mx^2}{2a} + \frac{an - bm}{a^2} + \frac{a^2p - abn + b^2m}{a^3} \log(ax + b) : \int x^2 dx = \frac{1}{3}(x^{\frac{1}{2}} + a^{\frac{1}{2}})(x^{\frac{1}{2}} - a^{\frac{1}{2}})
                                   \int x^{1} dx = \frac{1}{4} x^{2} = \frac{1}{4} \left( x^{2} + ax + \frac{a^{2}}{2} \right) \left( x^{2} - ax + \frac{a^{2}}{2} \right), \text{ etc.} : \int \frac{dx}{x(ax^{2} + bx + c)} = \int \frac{dx}{x \not o} \text{ ; put } \beta = b^{2} 4ac,
                                \int \frac{dx}{x \not \phi} = \frac{1}{2c} \log \frac{x^2}{\cancel{\phi}} - \frac{b}{2c} \int \frac{dx}{\cancel{\phi}} , \text{ see above} : \int \frac{dx}{x^2 \not \phi} = \frac{1}{cx} - \frac{b}{2c^2} \log \frac{x^2}{\cancel{\phi}} + \frac{b^2 - 2ac}{2c^2} \int \frac{dx}{\cancel{\phi}} , \text{ see above} :
                                   \int \! x^m dx = \frac{x^{m+1}}{m+1} - \frac{ax^{m+1} + b}{a(m+1)} : \int \! \frac{dx}{x^m} = -\frac{1}{(m-1)x^{m-1}} = -\frac{a+bx^{m-1}}{(m-1)ax^{m-1}}
                                       \int x^{-(1+\varepsilon)} dx = \frac{x^{-\varepsilon} - 1}{-\varepsilon} = \frac{e^{-\varepsilon \log x} - 1}{-\varepsilon} = \log x - \frac{1}{2!} \varepsilon (\log x)^2 + \frac{1}{3!} \varepsilon^* (\log x)^3 - \frac{1}{4!} \varepsilon^3 (\log x)^2 + \dots = \log x \text{ for } \varepsilon = 0
                                   \int \sin(ax+b)\,dx = -\frac{1}{a}\cos(ax+b): \int \cos(ax+b)\,dx = \frac{1}{a}\sin(ax+b): \int \tan x\,dx = -\log\cos x:
                                   \int \tan(ax+b)dx = -\frac{1}{a}\log\cos(ax+b); \int \cot(ax+b)dx = \frac{1}{a}\log\sin(ax+b);
                                   \int \frac{dx}{\sin(ax+b)} = \frac{1}{a} \log \tan \frac{1}{2} (ax+b) : \int \sin ax \sin bx dx = \frac{1}{2} \left\{ \frac{\sin(a-b)x}{a-b} - \frac{\sin(a+b)x}{a+b} \right\} :
                                          General Formulæ. \int f(x) dx = xf(0) + \frac{x^2}{2!}f(0) + \frac{x^3}{3!}f'(0) + \dots  U_1 = \int U dx : U_2 = \int U_1 dx : U_3 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_1 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx : U_4 = \int U_4 dx
                                          \mathbf{U}' = \frac{d}{dx}\mathbf{U} : \mathbf{U}'' = \frac{d}{dx}\mathbf{U}' \qquad \int \mathbf{U} \, dx = x\mathbf{U} - \frac{x^2}{2!}\mathbf{U}' + \frac{x^3}{3!} - \dots = x\mathbf{U} - \int x\mathbf{U}' dx : \int \mathbf{U}' \mathbf{V} dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \int \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \mathbf{U}\mathbf{V}' dx = \mathbf{U}\mathbf{V} - \mathbf{U}\mathbf{V} - \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} - \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} - \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}\mathbf{V} + \mathbf{U}
                             \int (U'\nabla + U\nabla') dx = U\nabla : \int (aU + b)^m U' dx = \frac{(aU + b)^{m+1}}{a(m+1)} : \int \frac{U}{(U + V)^m} dx = \int \frac{dx}{(U + V)^{m-1}} - \int \frac{\nabla}{(U + V)^m} dx :
                          \int \frac{\overline{U}'}{\overline{U}} dx = \log \overline{U} = -\frac{1}{m} \log \frac{1}{\overline{U}^m} : \int \frac{\overline{U}'}{\overline{U}^m} dx = -\frac{1}{(m-1)} \frac{1}{\overline{U}^{m-1}} : \int \frac{\overline{VU}'}{\overline{U}^1} dx = -\frac{\overline{V}'}{\overline{U}} + \int \frac{\overline{V}'}{\overline{U}} dx = -\frac{\overline{V}'}{\overline{U}^n} + \frac{\overline{V}'}{\overline{U}^n} dx = -\frac{\overline{V}'}{\overline{U}^n} + \frac{\overline{V}'}{\overline{U}^n} +
                          \int \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{V}^2} dx = \frac{\overline{U}}{\overline{V}} : \int \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V}} dx = \log \frac{\overline{U}}{\overline{U}} : \int \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U}^2 + \overline{V}^2} dx = \arg \tan \frac{\overline{U}}{\overline{V}} : \int \frac{\overline{U} \overline{V}^2 + \overline{V} \overline{U}^2}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \log \frac{\overline{U} \overline{V}}{\overline{U} + \overline{V}} : \int \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} (\overline{U} + \overline{V})} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V} - \overline{U} \overline{V}'}{\overline{U} \overline{V} - \overline{U} \overline{V} - \overline{U} \overline{V}'} dx = \lim_{n \to \infty} \frac{\overline{U} \overline{V} - \overline{U} \overline{V} - \overline{U} \overline{V} - \overline{U} \overline{V} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - \overline{U} - 
                          \int U \log x \, dx = U_1 \log x - \int \frac{U}{x} \, dx : \int V \log U \, dx = V_1 \log U - \int \frac{U'V}{U} \, dx : \int U(\log x)^n dx = V_1 \log U - \int \frac{U'V}{U} \, dx = V_2 \log x - \int \frac{U}{x} \, dx = V_3 \log x - \int \frac{U}{x} \, dx = V_3 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, dx = V_4 \log x - \int \frac{U}{x} \, d
                = U_1(\log x)^n - n \int \frac{U_1(\log x)^{n-1}}{x} dx = U_1(\log x)^{n} \cdot n U_2(\log x)^{n-1} + n(n-1) U_1(\log x)^{n-1}.
                          \int \!\! \mathrm{U} e^{ax} dx = \frac{1}{a} \!\! \mathrm{U} e^{ax} - \frac{1}{a} \!\! \int \!\! \mathrm{U}' e^{ax} dx = \frac{e^{ax}}{a} \!\! \left\{ \!\! \mathrm{U} - \frac{\mathrm{U}'}{a} \!\! + \! \frac{\mathrm{U}''}{a^2} \!\! - \! \cdots \!\! \frac{(-1)}{a^n} \!\! \mathrm{U}^{(n)} \!\! \right\} ; \quad \int \!\! \frac{e^x}{x} dx = \int \!\! \frac{dx}{\log x} \; , \; e^x \!\! - \! \frac{x}{a} \!\! \cdot \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - \! \frac{1}{a^n} \!\! - 
         \int \mathbf{U} a^x dx = \frac{\mathbf{U} a^x}{\log a} - \frac{1}{\log a} \int \mathbf{U}' a^x dx = \mathbf{U}_1 a^x - \log a \int \mathbf{U}_1 a^x dx = \frac{\mathbf{U} a^x}{\log a} \frac{\mathbf{U}' a^x}{(\log a)^2} + \frac{\mathbf{U}' a^x}{(\log a)^3} - \mathbf{U}_1 a^x - \mathbf{U}_2 a^x \log a + \frac{\mathbf{U} a^x}{\log a} = \frac{a^{mx+n}}{m \log a} : \text{ thus } \int e^{mx} dx = \frac{1}{m} e^{mx} : \text{ and } \int e^{mx+n} dx = \frac{1}{m} e^{mx+n} :
         \int x^m a^3 dx = \frac{a^x}{\log a} \left\{ x^m - \frac{mx^{m-1}}{\log a} + \frac{m(m-1)x^{m-2}}{(\log a)^x} - \pm \frac{m(m-1) - 2.1}{\log a^m} \right\} : \int \frac{e^{ax}}{x} dx = \log x + \frac{ax}{1!} + \frac{1(ax)^3}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2!} + \frac{1}{2
                                   +\frac{1}{3}\frac{(ax)^3}{3!}+\cdots:\int x^m a^{nx} dx = \int \left\{1 + \frac{nx \log x}{1} + + \frac{n^k x^k (\log x)^k}{k!} + \cdots\right\} x^m dx
```

### Table of Integrals and Limits.

$$\int_{x^{m}}^{A} dx = -\frac{a^{*} \log a}{(m - 1)(x^{m - 1} - \frac{a^{*} \log a}{(m - 1)(m - 2)(x^{m - 2} - \frac{a^{*} (\log a)^{n - 2}}{(m - 1)(m - 2)(x^{m - 2} - \frac{a^{*} (\log a)^{n - 2}}{(m - 1)(x^{m - 2} - \frac{a^{*} (\log a)^{n - 2}}{(m - 1)(x^{m - 2} - \frac{a^{*} (\log a)^{n - 2}}{(m - 1)(x^{m - 2} - \frac{a^{*} (\log a)^{n - 2}}{(m - 1)(x^{m - 2} - \frac{a^{*} (\log a)^{n - 2}}{4^{*} - \frac{a^{*} (\log a)^{n - 2}}} + \frac{a^{*} (\log a)^{n - 2}}{(m - 1)(x^{m - 2} - \frac{a^{*} (\log a)^{n - 2}}{4^{*} - \frac{a^{*} (\log a)^{n - 2}}{4^{*} - \frac{a^{*} (\log a)^{n - 2}}} + \frac{a^{*} (\log a)^{n - 2}}{(m - 1)(x^{m - 2} - \frac{a^{*} (\log a)^{n - 2}}{4^{*} - \frac{a^{*} ($$

In the above Tables the sign "=" merely denotes that a following quantity is also a value of the integral, not that it is necessarily equal, as will be obvious in the first few examples. The general formulæ facilitate the integration of many types of expression occurring in statistics.

### XVIII. - CONCLUSION.

1. The larger aim of population statistic.—Inasmuch as population is the foundation-element of all branches of social statistics, its complete study is both of practical value and general interest. For this reason an adequate "theory of population" has become a necessity. Moreover, international relationships have made it evident that the proper co-ordination of the whole world's statistical method and effort has become an imperious need of civilisation.  $^1$  This emphasises the importance of the formation of a basis for international comparisons, and is a desideratum yearly becoming more urgent. Only by a sufficiently wide survey of human facts can the required norms of all sorts be established, norms which represent the characters of the great unit constituted by the aggregation of all the nations. It is only in the comparatively slow secular changes of these norms, that the drift of mankind in the gross can be unequivocally revealed; when that drift is ascertained, the quicker and more marked variations of individual nations and populations can then be forced to disclose the real significance of their differentiating tendencies. The limits of human expansion are much nearer than popular opinion imagines; the difficulty of future food supplies will soon be of the gravest character; the exhaustion of sources of energy necessary for any notable increase of population or advance in the standards of living, or both combined, is perilously near. Within periods of time, insignificant compared with geologic ages, the multiplying force of living things, man included, must receive a tremendous check. The present rate of increase in the world's population cannot continue for four centuries,2 and the extraordinary increase in the standard of living which has characterised the last few decades must quickly be brought to a standstill, or be determined by the destructive forces of human extravagance. Very soon world-politic will have to face the question whether it is better that there should be larger numbers and more modest living, or fewer numbers and lavish living; whether world-morality should aim at the enjoyment of life by a great multitude, or aim at the restriction of life-experience to a few, that they may live in relative opulence. The statistician of the

<sup>&</sup>lt;sup>1</sup>This is the raison d'etre of the "Institute International de Statistique," and the ideal aim which its activities have in view.

If we take the present population as about 1,700,000,000, and the annual rate of increase as 0.01159 the increase doubles the population in 60.15 years, and gives a population 3.16 times as great in 100 years; thus in 200 years the population will have increased 10-fold, and in 400 years 100-fold. We thus get, at the end of successive centuries, the following populations in round numbers:—100 years, 5,380,000,000; 200 years, 17,040,000,000; 300 years, 53,930,000,000; 400 years, 170,710,000,000.

future will utilize all discovery of the mysterious play, and no less cryptic, limitation of life-force to make prediction sure. Given coordinated international effort, there would be no difficulty in so directing future statistical technique that all countries and all analysts could add their quota in a form suitable for the wider study of the drift of mankind in the more important relations of civic, national, and international life.

In earlier days monarchs utilized statistic as a basis for judging the probability of success in operations of war and plunder. That use has not disappeared, but the plexus of relations, which, through the fructifying power of science, the modern world has seen established, particularly in the realms of industry and commerce, has shewn a growing measure of economic solidarity in the affairs of mankind. The modern world responds to everything that profoundly touches any one nation. By the conditions of modern life mankind tends to be welded into a unit. By the magic of invention, humanity has been quickened; distance—if not annihilated—has been immensely shortened; life has been enriched in the potentialities of material and psychical enjoyment, and be it said also in the plane of its possible intellectual and moral effort. The destiny of mankind will therefore be the supreme problem of those statisticians of the future, who have an adequate outlook on that science and art with which it is their privilege to concern themselves. For the craftsman with acute and microscopic vision there are a multitude of analyses to be made; for one with the capacity for reaching wide generalisations there is no end of larger work, while for him who is happily able to see both the trees and the forest of the statistical landscape, there is the most farreaching task of all, the creation of a statistical world-picture, which shall reveal the secrets of man's place in the many-sided world of socialeconomics, using that word in its fullest and most ideal sense.

2. The impossibility of any long-continued increase of population at the present rate.—An increase of population at the rate of 1 per cent. per annum is often regarded as unduly slow; the increase for the United States between 1790 and 1860 was nearly 3 per cent. per annum, a rate which has recently also been attained in Australia. That this rate cannot possibly last even five centuries is a fact, however, that, though immensely important, is not realised.

It has been contended in reply to Malthus that experience has shewn that food-production will advance even more rapidly than the growth of population. It can do so for only a very limited time. The false inference has been drawn from this fact that therefore almost any population can be provided for. The point demands attention, for the argument is a plausible one. Notwithstanding this it is invalid, as can easily be shewn.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> See L. Hirsch, La théorie de la population de Th. R. Malthus, Bibliothèque Universelle, Dec. 1916, No. 252, pp. 553-567, and Jan. 1917, No. 253, pp. 141-154.

If the earth's present population be taken as low even as 1,500,000,000 persons (which is, of course, an underestimate), and its land area, excluding the Arctic and Antarctic continents, be assumed to be, say, 33,000,000,000 acres; and if further it is supposed that by some means it is possible to make the whole of this land-area yield an average of as much as 22.8 bushels of food-corn per acre, per annum, the total yield would be only 752,400,000,000 bushels.

In Australia, and in fact generally, the food-corn consumption is on the average, about equivalent to 5.7 bushels per annum, viz., onefourth of the amount above assumed, which means that the total population which could be fed with 5.7 bushels of food-corn per annum together with other foods in like proportion, would be only 132,000,000,000. At a rate of increase of population of 0.01 per annum, somewhat less than the rate for all countries which have accurate statistics, it would require only 450 years to exhaust the food requirement mentioned (more exactly 449.96 years). That no possible increase of the earth's reproductiveness can materially affect the question can also be readily shewn. For—to postulate the impossible—let it be supposed that every acre of area on the earth's entire surface could produce as much as 228 bushels, that is, ten times the above amount, with other foods in like proportion: this being done, it would take less than 700 years (681.37 years) for the population to exhaust the food supply. The fundamental element in Malthus' contention is thus seen to be completely established. Even a low rate of increase must soon exhaust the possibilities of food-supply, and as we have seen already the material of the earth is inadequate to provide bodies for any long-continued increase quite apart from the food question. It is quite clear therefore that statistical analyses of the world's progress in various ways will soon become of the highest order of importance.

3. Need for analysis of existing statistical material.—At present there exists a large and accumulating mass of unanalysed material. Numerical data have in many instances already become a burden, and in other cases threaten to become one. But when their significance has been penetrated they seem no longer tedious; they have been transformed into illuminating and interesting facts.

Here, however, we need a word of warning. The problem of all so-called knowledge is to subsume what we know—or think we know—under suitable elementary conceptions, conceptions, in fact, that are within our intellectual grasp, and that we can mentally handle. As in physics the Boyle-Charles gaseous laws, the molecular law of equal numbers in equal volumes at equal pressures and temperatures, and the conception of mass

The number of years in which a population is doubled is given by the following quantities divided by the increase. When the increase or divisor is .000 .010 .020 .030 .040 .050 the numerator is .6931 .6966 .7001 .7035 .7069 .7103 (See also footnote p. 31.)

as independent of velocity, are but crude statements of the actual facts, so crude that their elementary simplicity entirely disappears when necessary qualifications are made, so likewise does a deeper knowledge of statistic reveal that relations subsisting among crude data are subject to corrections that, not infrequently, are very elaborate. The more simple and obvious of these relations constitute a kind of rough frame-work about which more subtle and accurate conceptions may cluster, or, to change the figure, they are a skeletal foundation on which the body of justly conceived statistic is to be built up.

- 4. The trend of destiny.—To the extent man is ignorant, he is both the pupper of Fortune, and the victim of Desire. Anyone who has seriously reflected upon the facts of the last ten decades must realise that, within the next ten, tremendous problems will arise for solution and these will touch fundamentally the following matters, viz.:—
  - (i.) The multiplying power of the human race;
  - (ii.) The organic constitution of Nature and the means at human disposal for avoiding the incidence of its unfavourable aspects;
     i.e., eugenics in its wider sense;
  - (iii.) The enhancing of the productivity of Nature, and the limits of its exploitation;
  - (iv.) The mechanism of the social organism, and the scheme of its control;
  - (v.) Internationalism and the solidarity of humanity.

For the adequate study of these matters, not only will the mere technique of the collection and analysis of statistic require to be much advanced, but the popular opinion as to the value of the effort will also have to progress. Given, however, an intelligent public opinion, as to the utility of statistical inquiries, there would be some ground for hope that the great questions, the analysis of which would throw light upon human destiny, could be properly attacked. It is for educational departments, worthy of the name, to create such opinion by the mechanism of their systems, in order that each human being should be sufficiently interested to cordially co-operate, by accurately furnishing the necessary data in the taking of a census of population or wealth. Census-taking is a costly operation, but it is the foundation of all branches of statistic that have a direct human interest. Its value and the facility of using it would be immensely increased if it were meticulously accurate. The importance of technique and of precision, matters apparently of little moment, can be rightly estimated only when the ultimate aim of all statistical inquiry is realised to be "the study of man's destiny" as the denizen of a world of limitations.

<sup>&</sup>lt;sup>1</sup> According to modern views" mass" in matter becomes infinite when its velocity equals that of light.

<sup>&</sup>lt;sup>2</sup> Thus, for example, the crude mortality of one population may agree with that of another, but when corrected may seriously differ, shewing either a better or worse state of things regarding the conditions of human life.

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# APPENDIX B.

ON THE MATERIALS FOR, AND THE CONSTRUCTION OF, TABLES OF NATALITY, ISSUE AND ORPHANHOOD.

A Paper read by Mr. CHAS. H. WICKENS, A.I.A., Supervisor of Census, Commonwealth Bureau of Census and Statistics, Melbourne, on 18th August, 1914, at the Australian Meeting of the British Association for the Advancement of Science.

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### 1. Objects of paper.—The objects of the present paper are—

- (i.) to briefly review the data requisite and available for the construction of tables of natality, issue and orphanhood, and the purposes for which such tables are required;
- (ii.) to specially indicate material of a valuable nature available for the purpose in the Vital Statistics of Australia;
- (iii.) to furnish a series of natality, issue and orphanhood tables for males based on the Australian experience;
- (iv.) to outline the methods adopted in the construction and graduation of these tables.

2. National data.-In the demographic field, which comprises the statistics of births, the natality table should occupy as prominent a place as that occupied by the mortality table in the cognate field comprising statistics of deaths. Unfortunately, however, for the interests of Demography, such is not the case, and whilst mortality tables are now published for most civilized countries, and extend in some cases over a long range of periods of observation, similar particulars in respect of births are not available. The cause of this defect is mainly the absence of the requisite material, and whilst statistics of ages at death are now regularly published in most countries, statistics of the ages of parents at the birth of their children are in most cases either not collected or are not published if collected. For the compilation of national natality tables, statistics of births according to the ages of the parents are essential. In the absence of such statistics, ingenious devices have been adopted for approximating to the results which these statistics would disclose, and some of these are discussed in later sections. Before leaving the present section, however, mention may be made of the interesting fact that for the year 1855 the Scottish birth registers contain very complete data in respect of births, which have been tabulated and analysed by Messrs. C. J. and J. N. Lewis in their "Natality and Fecundity." Boyd, Edinburgh, 1906.)

For 1856 and succeeding years the special details were not collected.

3. Social uses of natality statistics.—Apart from their demographic value as scientific data for the interpretation and analysis of the life of man, natality and kindred tables have very important uses in connection with various social requirements. An important occasion of this nature arose in the United Kingdom in 1911, when particulars as to the incidence of natality on the lives of the fathers were required in connection with the National Insurance scheme then under consideration. The object in view on that occasion was the determination of the cost of a maternity allowance to mothers, and the ascertainment of the appropriate premium chargeable for the benefit.

Another purpose for which statistics of this nature are required is that of determining the cost of orphan benefits in connection with superannuation and similar schemes. The data required in these cases are usually the numbers of orphans under specified ages that arise from time to time through the deaths of fathers of successive ages.

4. First National Insurance basis.—In their investigations in 1911 in connection with the National Insurance scheme, Sir G. F. Hardy and Mr. F. B. Wyatt, made an estimate of natality as a function

of the age of the father, which they based upon statistics of orphanhood for the Dominion of New Zealand, in the absence of data of an appropriate character relative to the United Kingdom itself. The data in question shewed for a series of years the number of orphans of each age that had arisen in consequence of the deaths of fathers of successive ages. working backwards, by means of a mortality table from the number of surviving orphans under 5 years of age to the number actually born, a natality table for New Zealand was constructed. This table of rates was then applied to the appropriate United Kingdom population, and the number of births which it disclosed was compared with the total actually recorded, the rates being then adjusted to bring the two results into accord. The adjustment applied was a reduction of the rates by 8 per cent. throughout. This method, whilst undoubtedly ingenious, has serious shortcomings, of which the most important are: (i.) the estimating of natality rates from orphanhood data, and (ii.) the assumption that the natality incidence so estimated for New Zealand was applicable to the United Kingdom. Even if an assumption of the latter class were allowed to pass, it is not clear why the actual data relative to natality, which have been available in Australia for many years past, should not have been employed, unless, possibly, their existence was unknown to the investigators.

- 5. Second National Insurance basis.—In 1912 the National Insurance actuarial advisory committee further considered the question of natality rates in connection with the maternity benefit, and on this occasion use was made of statistics derived from the returns for the Census of 1911 for the Metropolitan Borough of Camberwell. The Census data so employed were (i.) the number of husbands present with wives and of wives present with husbands in quinquennial age-groups; (ii.) for the same age-groups the number of husbands and the number of wives with one or more children under one year of age, twin births being treated in the same manner as single births. These figures represented the survivors of births which took place during the twelve months preceding the date of the Census, twin births being counted as single, and to obtain the total number of such occurrences during that period it was necessary to make allowance for—
  - (i.) deaths of children born during the period, who had died before the date of the Census;
  - (ii.) deaths of mothers at or after date of birth;
  - (iii.) deaths of fathers after date of conception.

Statistics on these points not being available, an addition of 10 per cent. was made to allow roughly for the adjustments required. From these adjusted figures natality rates for successive ages were computed, and

tested by application to the estimated population according to age at the middle of 1909. The result so obtained was compared with the mean of the recorded births for the period 1909-11 corrected to allow for twin births, illegitimate births and still births, and the natality rates were then subjected to such further correction as would make the computed births accord with the recorded.

- 6. Friendly Society experience.—Amongst the records of Friendly Society experience, data concerning natality, issue or orphanhood are very meagre, and one of the few cases in which such information is available is that given by Mr. A. W. Watson in his actuarial lectures on Friendly Societies. The data there furnished relate to the Hearts of Oak Benefit Society, and are given in age-groups, shewing the number of cases of claims in respect of maternity benefit made by male members of the Society of different ages, and the total number of male members of such ages. The records of the Society do not admit of an analysis of the membership according to conjugal condition, so that rates of natality in respect of males are obtainable only in respect of married and single combined. For many practical purposes, however, this is not a disadvantage, since premium rates in respect of maternity benefit are usually payable by all, whether married or single.
- 7. Orphanhood tables deduced from death statistics.—As previously noted in section 4 above, orphanhood tables have been constructed from death statistics in New Zealand for many years past, the data recorded being the number of children living at various ages who have been rendered orphans by the deaths of fathers of various ages. The importance of this information was recognised at a conference of Australasian Statisticians, held in Hobart in January 1902, at which a resolution was passed affirming the desirability "that information be published relative to the number of children rendered fatherless each year, shewing ages and sexes." Notwithstanding this resolution, which was agreed to unanimously, Western Australia was the only State of Australia which consistently carried out the desired tabulation, the details according to sexes of children having been published annually in that State for single ages of children to age 21, and for quinquennial age-groups in the case of fathers from 1903 onwards. Special investigations of a similar nature have been made in New South Wales for the years 1903 and 1911, but the tabulation has not been carried out annually as in the cases of New Zealand and Western Australia. In all such cases the possibility of making the desired investigation depends on the fact that the death registers contain provision for recording the age of the deceased and the ages of the surviving children.

- 8. Surviving issue tables deduced from service experience.—There are in Australia two other experiences of some importance in this matter, both of which have been obtained in connection with the Public Service in respect of proposals for superannuation. Each of them consists of a tabulation of the number of members in the respective services according to conjugal condition, and also of the number and ages of surviving children. The earlier of these comprised 12,253 male members of Commonwealth Public Service at 31st December, 1908, while the latter referred to 12,675 male members of the New South Wales Public Service at 31st December, 1910. Particulars concerning the former are contained in the Report on Superannuation by the Commonwealth Statistician, dated 19th October, 1910, and concerning the latter in the Departmental actuarial sub-committee's report, dated 12th April, 1912.
- 9. Summary.—It will be seen that of the sources of information quoted in the foregoing sections, one only, viz., the Hearts of Oak experience, relates to natality in relation to all males. Three others, viz., the annual returns of New Zealand and Western Australia, and the special 1903 and 1911 returns of New South Wales, relate to orphanhood, but only as at its initiation, that is to say, they furnish data respecting the numbers of each age who become orphans in any year, but not concerning the number of orphans of any age existing in the community at any point of time. Finally, three others, viz., the Camberwell experience referred to in 5, and the two service experiences referred to in 8, relate to surviving issue. Of these data all are of importance for different purposes, but probably the most valuable is that relating to natality, so much so, that as seen in 4 and 5 above, data concerning orphanhood and surviving issue have both been pressed into the service for obtaining estimates of natality.
- 10. Australian natality statistics.—As previously noted, the ignoring of the extensive Australian statistics of natality appears explicable only on the supposition that its existence was unknown; yet records of the ages of fathers and mothers at the birth of their children have been published annually in New South Wales since 1893, in Victoria and in Western Australia since 1903, and for the Commonwealth of Australia as a whole, as well as for each State separately, in the publications of the Commonwealth Bureau of Census and Statistics since 1908, and for all the States except South Australia for 1907 also. These Commonwealth results furnish additional information of interest, inasmuch as they supply for each of the States and the Commonwealth separate particulars for single births, twin births, and triplet births, tabulated according to the ages of the fathers and mothers either separately or in combination. These latter data enable particulars to be obtained not only of the number of births occurring to parents of a given age, but also of the number of children so born, and hence permit of the computation of the variation with the age of the parents of the average number of children to a birth.

- 11. Nuptial and ex-nuptial births.—The births referred to in the preceding section are those which have arisen in wedlock, and which are usually termed "legitimate" births. In the Commonwealth Bureau of Census and Statistics the terms "Nuptial" and "Ex-nuptial" are now employed in place of the terms "legitimate" and "illegitimate," as it is considered that the latter terms connote more than the occurrences warrant, and that the former terms more nearly express the fact. The former terms have been used throughout the remainder of the present paper. As the father does not appear in the registration of ex-nuptial births, the age data relative to such births necessarily relate solely to those of the mothers. For the purpose of the tables given in this paper, data relative to males only have been dealt with, and consequently all rates furnished relate to nuptial births, except in cases where special calculations have been made to allow for ex-nuptial births for the purpose of comparing results. In this connection it may be noted, that during the four years 1909-12, the total number of births registered in Australia was 486,153, of which 28,013, or 5.76 per cent., were ex-nuptial, the ratio of ex-nuptial to nuptial births being thus, 611: 10,000.
- 12. Natality table.—For the purpose of the tables contained in this paper, the data employed have been:—
  - (i.) The nuptial births registered in the Commonwealth of Australia during the four years 1909 to 1912, tabulated according to the ages of the fathers, and also according to whether the births were single births, twins, or triplets;
  - (ii.) the male population of the Commonwealth at the Census of 3rd April, 1911, tabulated according to age;
  - (iii.) the mean male population of the Commonwealth for each of the four years 1909 to 1912.

Items (i.) and (ii.) were graduated graphically, adjusted results being obtained for single ages, while from (iii.) and the adjusted form of (ii.), there was obtained the number of years of male life lived in Australia in each year of age during the period 1909 to 1912.

The ratio of the number of births at each age to the number of years of male life for the same age gave the nuptial natality rate for males irrespective of conjugal condition. These rates were then graphically graduated, the alterations so made being, however, very slight, as the rates obtained by division ran on the whole very smoothly.

The natality table so obtained for Australia was as follows, the figures given representing the ratio of the number of cases of nuptial births to the total number of males of the same age last birthday as the fathers concerned:—

TABLE I.—Australian Nuptial Natality Table for Males, 1909-12.

last p Birth- M day.	Ratio of Number of Cases of Iuptial Births her annum to Iean Number of Males of the same Age is the Fathers.	Age of Fathers last Birth- day.	Ratio of Number of Cases of Nuptial Births per annum to Mean Number of Males of the same Age as the Fathers.	Age of Fathers last Birth- day.	Ratio of Number of Cases of Nuptial Births per annum to Mean Number of Males of the same Age as the Fathers.
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37	.00006 .00031 .00160 .00617 .01331 .03007 .04838 .07037 .09081 .10882 .12517 .13941 .15363 .16417 .16679 .15984 .15505 .15279 .15037 .14751 .14422 .14108	41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 60 61 62	.11162 .09633 .08680 .07803 .06961 .06142 .05360 .04626 .03935 .02720 .02192 .01730 .01352 .01124 .00958 .00827 .00700 .00572 .00496 .00434	66 67 68 69 70 71 72 73 74 75 76 77 78 80 81 82 83 84 85 86 87	.00190 .00163 .00139 .00119 .00101 .00083 .00068 .00055 .00045 .00038 .00035 .00031 .00029 .00028 .00027 .00026 .00024 .00023

According to this table the Australian nuptial natality rate for all males commences at 6 per 100,000 at age 16, and increases to a maximum of 16 per cent. at age 30, and declines thereafter to 2 per 10,000 at age 88. In other words, according to the Australian experience under consideration, one male in every 17,000 at age 16 annually becomes a nuptial father at that age, one in 160 at age 19, one in 10 at age 25, one in 6 at age 30, one in 7 at age 36, one in 9 at age 41, one in 25 at age 49, one in 200 at age 60, one in 1000 at age 70, one in 4000 at age 83, and one in 5000 at age 88.

13. Children per confinement.—The figures given in the preceding table represent the numbers of cases of births per annum expressed as ratios of the mean number of males for the several years of age, and this is the form in which the information is required when it is a question of paying a specified benefit on the occurrence of a live birth irrespective of the number of children born thereat. For the purposes of issue and orphanhood tables, however, as well as in cases where benefits depend on

the numbers actually born, it is necessary to know also the number of children per confinement. As mentioned in section 10 above, the Australian data are furnished separately in respect of single births, twins and triplets, and hence it is possible to obtain a measure of the probability that a man becoming a father at any age will on that occasion become the father of twins or triplets. For the four years under review, viz., 1909-12, the number of single births in Australia was 448,721, of twin births 4644, and of triplet births 54, representing a total of 458,140 live-born children, after allowing for 31 twin and triplet children who were still-born. In this connection it may be noted that where, in the case of twins, one of the children, or in the case of triplets one or two of the children, are still-born, but one is born alive, the case is recorded as one of twins or triplets, but only the number of children born alive is recorded. Cases of twins or triplets in which all the children were still-born are not recorded in the Australian vital statistics except in the case of the State of Western Australia, concerning which a reference will be found in section 17 hereafter. From the figures given above it will be seen that for the four years 1909-12, the average number of live children per nuptial confinement was 1.01041, or roughly speaking, that one confinement in every 100 was a case of twins, and one in every 8500 was a case of triplets.

The average number of nuptial children per confinement was computed for each age of the father, and the results so obtained were plotted to scale, and graphically graduated, the result being as follows:—

Table II.—Average Number of Children per Nuptial Confinement.

Age of Father.	Average No. of Children per Confinement.	Age of Father.	Average No. of Children per Confinement.	Age of Father.	Average No. of Children per Confinement.
1.0	1.00947	4.1	1.01000		101400
16	1.00247	$\begin{array}{c} 41\\42\end{array}$	1.01233	66	1.01480
17	1.00362		1.01248	67	1.01486
18	1.00446	43	1.01263	68	1.01491
19	1.00510	44	1.01278	69	1.01496
20	1.00565	45	1.01292	70	1.01501
21	1.00615	46	1.01305	$\frac{71}{20}$	1.01506
22	1.00662	47	1.01317	$\frac{72}{50}$	1.01511
23	1.00707	48	1.01328	73	1.01516
24	1.00750	49	1.01339	<b>74</b>	1.01521
25	1.00792	50	1.01350	75	1.01525
26	1.00832	51	1.01360	<b>76</b>	1.01529
27	1.00871	52	1.01370	77	1.01533
28	1.00908	53	1.01380	78	1.01537
29	1.00944	54	1.01390	79	1.01540
30	1.00980	55	1.01399	80	1.01543
31	1.01015	<b>5</b> 6	1.01408	81	1.01546
32	1.01049	57	1.01416	82	1.01549
33	1.01080	58	1.01424	83	1.01551
34	1.01108	59	1.01432	84	1.01553
35	1.01132	60	1.01439	85	1.01555
36	1.01152	61	1.01446	86	1.01557
37	1.01170	62	1.01453	87	1.01559
38	1.01186	63	1.01460	88	1.01560
39	1.01202	64	1.01467	89	1.01560
40	1.01218	65	1.01474		

From this table it will be seen that the number of children per confinement increases with the age of the father, the curve representing the facts tending to become asymptotic at the older ages. Roughly speaking, it may be said that at age 16 one case in 400 results in a multiple birth, at 19 one in 200, at 21 one in 150, at 25 one in 125, at 31 one in 100, at 34 one in 90, at 42 one in 80, at 48 one in 75, and at 59 one in 70.

14. Issue table.—A combination of the results in the two preceding tables gives the initial issue rates for successive ages. I have not inserted a table shewing these, as the particulars, if required, can be readily computed from the tables in the preceding sections. One of the chief uses of an issue table is that of shewing for each male age the number of surviving children at each age, and thus enabling an estimate to be made of the liability in respect of orphan benefits that would be cast on a fund in consequence of the death of a male of any given age.

For this purpose it is necessary to relate the data to some exact age of the males. For example, as given, the data indicate that a specified number of males during the year of age from 25 to 26 become fathers, and as the births then resulting will be distributed over the year of age more or less uniformly, it will follow that at any point of time there will be fathers of all intermediate fractional ages from 25 to 26 with children in the first year of age of all fractional ages from 0 to 1. For convenience in subsequent use, these data were reduced by allowing for infant mortality, also for deaths of males, so as to show the number of surviving children under one year of age corresponding to the number of males who attained the exact age 26. In the actual construction of such an issue table, it is thus necessary to take into account the rate of mortality amongst the children, and also amongst the males. The rate of mortality adopted on the present occasion was the most recent table for the Commonwealth of Australia, that for the decennium 1901-10. In this table the rates are given separately for males and females, and to obtain a basis for the children of both sexes the weighted mean of these rates was taken, the weighting employed being the ratio of male to female births for the years 1909-12. The mortality table for males was recast, so as to shew the number of males surviving at each age out of 100,000 coming under observation at age 14.

The figures so obtained are shewn in the following table:—

Table III.—Surviving Nuptial Children under One Year of Age, Corresponding to

Males Surviving out of 100,000 at Age 14.

Age of Father.	Males Sur- viving out of 100,000 at Age 14.	Surviving Nuptial Children under 1 Year of Age.	Age of Father.	Males Sur- viving out of 100,000 at Age 14.	Surviving Nuptial Children under 1 Year of Age.	Age of Father.	Males Sur- viving out of 100,000 at Age 14.	Surviving Nuptial Children under 1 Year of Age.
16	99,521	۱ ۰۰ ا	41	87,539	10,650	66	54,421	119
17	99,242	6	42	86,787	9,322	67	52,119	97
18	98,940	29	43	85,997	7,975	68	49,699	80
19	98,612	150	44	85,167	7,120	69	47,161	65
20	98,268	578	45	84,296	6,338	70	44,515	52
21	97,904	1,243	46	83,383	5,595	71	41,772	42
22	97,522	2,798	47	82,430	4,882	72	38,948	32
23	97,127	4,486	48	81,437	4,211	73	36,060	25
24	96,721	6,501	49	80,411	3,590	74	33,131	18
25	96,302	8,357	50	79,343	3,015	75	30,195	14
26	95,870	9,974	51	78,237	2,490	76	27,293	11
27	95,425	11,425	52	77,093	2,027	77	24,463	9
28	94,969	12,671	53	75,907	1,609	78	21,734	7
29	94,500	13,901	54	74,676	1,250	79	19,128	6
30	94,024	14,784	55	73,396	961	80	16,666	5
31	93,537	14,949	56	72,063	~ 785	81	14,368	4
$\bf 32$	93,032	14,255	57	70,669	656	82	12,244	3
33	92,512	13,757	58	69,206	555	83	10,301	3 2
34	91,975	13,483	59	67,663	460	84	8,540	2
35	91,423	13,195	60	66,039	367	85	6,972	2
36	90,843	12,867	61	64,333	310	86	5,598	1
37	90,241	12,501	62	62,539	264	87	4,417	1
38	89,612	12,148	63	60,656	213	88	3,420	1
39	88,951	11,811	64	58,681	177	89	2,593	1
40	88,259	11,394	65	56,605	146			
					<u> </u>	<u> </u>	l	1

From the results given in the preceding table, detailed tabulations have been prepared shewing on the basis of the Australian mortality experience 1901-10, and the Australian birth experience 1909-12, how many children in each year of age up to 20 would be surviving on the attainment by their fathers of successive ages. In other words, the process records the growth of the second generation as a function of the age of the first generation. There are 100,000 males assumed as under observation at 14, and these are carried through the succeeding ages by means of the life table. Similarly, at each age attained by the fathers, there are new entrants on the second generation as well as the survivors of those who entered at the earlier ages of the fathers. By applying the appropriate probabilities of survival, these numbers are readily determined, and from the detailed table so computed, it may be seen how many out of 100,000 males of the first generation at age 14 there are surviving at say age 50, and corresponding thereto how many there are of the second generation in each year of age,

15. Orphanhood table.—One of the important uses to which such a table may be applied, is that of determining the rate of orphanhood in a community under given conditions. The term orphan is somewhat vague, but is generally used in this and similar discussions as applying to a child of dependent age whose father is dead. The upper limit of dependent age will vary under different circumstances, but for the purposes of the present paper it has been taken as 15. For example, it is clear that if marriage is deferred, and if the birth-rate remains fairly constant, there will be a tendency for an increase in orphanhood, since the probability of the father dying while the child is still young is increased by the deferment of marriage.

To obtain rates of orphanhood, it is necessary to work backwards from the results given in Table III. This table gives the number of children under one year of age corresponding to the males of the first generation of a given exact age, but, clearly, some of these children will already be orphans. Not only so, but some are orphans at birth, the father having died before the birth of his child. For example, at age 26 in Table III., there are shewn 9974 children under one year of age. These represent the number of children born to fathers aged 25 last birthday, and surviving when the father reaches age 26, or to the time at which he would have reached it if he had survived. On the average, therefore, the father of these children must at date of conception have been aged 243 years, and the number of children amongst them who are not orphans will be found by multiplying the total of 9974 by the probability that a male aged 243 will reach age 26. A calculation similar to this has been made for each age, and the results obtained give the number of children under one year of age whose fathers are living, the subtraction from the total figures giving the number of orphans under one year of age corresponding to each age of the first generation.

The complete detailed table of children not orphaned has been prepared in the manner above indicated by making an allowance at each age for the survival of the father in conjunction with the survival of the child. This table furnishes the number of surviving non-orphaned children of each age corresponding to males of a given age, and is of value in such questions as those concerning the average number of children of dependent age which a male of a given age has to support.

The following table gives the number non-orphaned, orphaned, and total children under the age of 15 corresponding to the number of males of the first generation shewn in Table III., and repeated here:—

Table IV.—Children Under Fifteen corresponding to Males Surviving out of 100,000 at Age 14.

Ages of Males.	Males Surviving out of 100,000 at Age 14.	Corresponding Children Under 15.			Ages	Males Surviving	Corresponding Children Under 15.			
		Whose Fathers are Living.	Orphans.	Total.	of Males.	out of 100,000 at Age 14.	Whose Fathers are Living.	Orphans.	Total.	
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 43 44 45 44 45 44 49	99,521 99,242 98,940 98,612 98,268 97,904 97,522 97,127 96,721 96,870 94,969 94,500 94,024 93,537 93,032 92,512 91,975 91,423 90,241 88,612 88,951 88,259 87,539 86,787 85,167 84,296 83,383 86,787 84,296 83,383 81,437 81,437	6 34 183 749 1,955 4,667 8,966 15,152 23,935 32,367 42,978 54,664 67,407 80,868 94,310 106,925 118,939 130,485 141,271 151,062 159,070 165,211 171,236 171,112 168,468 171,112 168,468 171,112 168,468 171,112 168,468 171,112 168,468 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 171,112 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258 192 140 103 73 53 38 86 18 16 10	7,220 6,588 5,963 5,357 4,766 4,208 3,681 3,191 2,749 2,356 2,019 1,742 1,522 1,350 1,203 1,069 829 733 640 557 480 408 345 221 164 133 108 86 67 57	48,576 41,701 35,530 30,001 25,113 20,842 17,146 13,991 11,340 9,150 7,366 4,861 4,019 3,332 2,755 2,266 1,853 1,527 1,251 1,016 666 537 431 345 274 217 171 134 104 83 67 54	
50 51 52 53	79,343 78,237 77,093 75,907	103,422 93,991 84,586 75,247	11,125 10,868 10,502 10,026	114,547 104,859 95,088 85,273	91 92 93 94	1,388 977 667 442		36 29 23	36 29 23	
54 55 56	74,676 73,396 72,063	66,020 57,040 48,664	9,428 8,716 7,945	75,448 65,756 56,609			3,815,980	288,653	4,104,633	

16. Application of results to Australian Census experience.—The figures now obtained may be considered as shewing, in so far as nuptial offspring are concerned, the normal relations between successive generations which are subject to the birth and death rates employed in this investigation, and consequently should, when applied to the Australian Census data for adult males for 1911, give approximately the numbers of nuptial children under the age 15 whose fathers are living, and those whose fathers are dead. Before the aggregate so obtained can be compared with the Census results for children under 15, an allowance must be made for children of ex-nuptial birth. As previously mentioned, the ratio of ex-nuptial to nuptial births for Australia for 1909-12 was 611:10,000 and as ex-nuptial children are usually subject to higher rates of mortality on the average than those of nuptial birth, the number of ex-nuptial children under the age of 15 have, in the absence of more complete data, been taken as  $5\frac{1}{2}$  per cent. of the number of nuptial children of the same age.

When these calculations were made, the total so obtained was 1,418,909, as compared with 1,409,823, the actual Census figures, a discrepancy of only 9086 in a total of 1,409,823, or about  $6\frac{1}{2}$  per 1000. This discrepancy is due to the fact that the number of births in Australia, which reached a maximum of over 110,000 in 1891, fell considerably in succeeding years, and stood at or about 100,000 per annum for the six years 1898 to 1903, rising fairly rapidly in succeeding years, and exceeding 122,000 for 1911.

For the purpose of estimating the number of orphans under 15 in the Census population, the items obtained from the orphanhood table were proportionately reduced, and the figures obtained were as follows:—

# Estimate as to Orphanhood and Ex-nuptial Birth of Australian Children under 15 at Census of 3rd April, 1911.

Children of Nuptial Birth-				
Whose Fathers were Living			 	 1,253,123
Orphans			 	 83,200
Children of Ex-nuptial Birth	• •		 	 73,500
Total Children under 15 at	Data	~£ (7.		1 400 823

It will be seen from these figures that the number of orphans under 15 in Australia represents 5.9 per cent. of the number of children of that age. On this basis the number at the present time (August, 1914) in Australia would be approximately 91,500.

- 17. Still births.—Where benefits payable in respect of maternity are payable whether the child is born alive or dead, it is necessary to obtain particulars respecting still as well as live births. In only one of the Australian States, viz., Western Australia, are still-births registered. From the experience of that State for the years 1909-12, it appears that the total number of still-births of viable age represents 3 per cent. of the number of live births. In making a computation for a benefit payable whether the child is alive or dead, it will be necessary, therefore, to increase the natality figures by this percentage.
- 18. Conclusion.—From an examination of the data employed in the preparation of the present paper, it is clear that such tables as those contained in it can only be of service for a population similarly circumstanced to that of Australia. An essential feature is the ratio of nuptial births to male population at each age, and this again is determined in part by the ratio of married to total males at each age. In Australia this latter ratio is very similar to that for New Zealand, but is markedly different to the corresponding ratio for the United Kingdom, the proportion unmarried being considerably greater in Australia and New Zealand.

Such conclusions indicate the necessity for complete records in each country as contrasted with dependence on other countries' results, and suggest that even a sample record such as that obtained from the borough of Camberwell may not give reliable results for the whole Kingdom.

For reliable tables of natality, issue, and or phanhood three things are required :—  $\,$ 

- (i.) Census results according to age.
- (ii.) Death registrations according to age of deceased.
- (iii.) Birth registrations according to ages of parents at the date of the birth registered.

With these, authentic tables can be compiled. The present paper has dealt entirely with natality, etc., as functions of the age of the father, as this is the phase of the question which has been most in requisition for practical use. The data, however, are available for dealing with these matters as functions of the age of the mother, and are at present being investigated.